



RELATIVE HUMIDITIES IN GREAT BRITAIN

O U R H O M E

I S L A N D S :

T H E I R N A T U R A L F E A T U R E S :

L O N D O N :

T H E R E L I G I O U S T R A C T S O C I E T Y ;

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CONTENTS.



CHAPTER I.

	PAGE
THE BRITISH ARCHIPELAGO—GREAT BRITAIN AND IRELAND	1

CHAPTER II.

THE SUBORDINATE INHABITED ISLANDS	20
---	----

CHAPTER III.

THE SEAS AND SHORES	50
-------------------------------	----

CHAPTER IV.

THE GREAT GEOLOGICAL FORMATIONS	81
---	----

CHAPTER V.

HIGHLAND AND LOWLAND REGIONS	119
--	-----

CHAPTER VI.

THE INLAND WATERS	157
-----------------------------	-----

CHAPTER VII.

	PAGE
THE CLIMATE	186

CHAPTER VIII.

GENERAL BOTANICAL FEATURES	210
--------------------------------------	-----

CHAPTER IX.

GENERAL ZOOLOGICAL FEATURES	246
---------------------------------------	-----

CHAPTER X.

MODERN GEOLOGICAL CHANGES	281
-------------------------------------	-----

REFERENCE TO FRONTISPIECE.

	FEET.
1 Ben Macdui, Aberdeenshire	4,390
2 Ben Novis, Inverness-shire	4,368
3 Cairntoul, Aberdeenshire	4,245
4 Ben Aven, Aberdeen and Banffshire	3,967
5 Ben Lawers, Perthshire	3,945
6 Cairngorm, Inverness and Banffshire	4,095
7 Ben Cruachan, Argyleshire	3,670
8 Ben More, Perthshire	3,818
9 Schiehallien, ditto	3,513
10 Snowdon, Caernarvonshire	3,571
11 Sea-Fell, Cumberland	3,166
12 Saddleback, ditto	2,737
13 Cader Idris, Merionethshire	2,914
14 Cross-Fell, Cumberland	2,901
15 Helvellyn, ditto	3,055
16 Skiddaw, ditto	3,022
17 Ben Lomond, Stirlingshire	3,195
18 Wharncote, Yorkshire	2,385
19 Ingleborough, ditto	2,361
20 Pennigant, ditto	2,270
21 Plynlimmon, Montgomery, and Cardiganshire	2,463
22 Kinderscout, Peak of Derbyshire	1,981
23 Yester Beacon, Devonshire	2,077
24 Cawsand Beacon, ditto	1,792
25 Dunkerry Beacon, Somersetshire	1,668

REFERENCE TO VANTISPIECE

	F.E.E.T.
26 Mam Tor, Derbyshire	1,709
27 Rippon Tor, Devonshire	1,549
28 Mendip Hills, Somersetshire	1,100
29 Malvern Hills, Worcester Beacon	1,444
30 Salisbury Plain, Wiltshire	400-500
31 Inkpen Beacon, Hampshire	1,011
32 Kit Hill, Cornwall	1,067
33 Dunmoe Head, Isle of Wight	792
34 Bardon Hill, Leicestershire	853
35 Ditchling Beacon, Sussex	853
36 Village of Leadhills, Lanarkshire	1,280
37 Cromford and High Peak Railway, summit level	1,290
38 Newcastle and Carlisle Railway, summit level .	446
39 Town of Birmingham	365
40 St. Paul's, London	370

OUR ISLAND HOME;

ITS NATURAL FEATURES.

CHAPTER I.

THE BRITISH ARCHIPELAGO—GREAT BRITAIN AND IRELAND.

Introductory Remarks—Progress of Investigation—Ordnance Survey—Position of the Archipelago—Range of Latitude—Inferior Range of the Moon Area and Population—Length of the Longest Day—Bright Midsummer Nights—A Naturalist in Sutherlandshire—Exaggerations of the Ancients—Difference of Longitude—Great Britain—Extent and Area—Form and Circuit—Ireland—Favourable Natural Circumstances—Centre of the Land Hemisphere—Influential Position.

GREAT BRITAIN, Ireland, and numerous subordinate isles adjacent, isolated or arranged in groups, compose the British Archipelago, and with the Channel islands, off the coast of France, constitute the home territory of the United Kingdom. This portion of the globe is of special interest as our native land; and is equally entitled to attention on general grounds. Though a comparatively small portion of the earth's surface—a speck upon the world's chart—it is the seat of one of the most powerful of existing nations, and the original home of the predominating state on the Trans-

Atlantic continent, the United States of America ; a scene of unsurpassed commercial activity, and grand mechanical inventions ; the centre of authority to an empire upon which the sun never sets ; and a source of influence to almost every inhabited region ; while, as its highest distinction, some of the noblest productions of literature, discoveries in science, and efforts to extend the rule of Christianity in the earth have had their birth-place within its bounds.

The character, temperament, and habits of mankind are in no slight degree influenced by the physical circumstances in which they live, comprising geographical position, the quality of the soil, the arrangement of the surface, and the conditions of climate. External nature may tend to invigorate health, excite the imagination, and quicken salutary feelings by an ever freshened atmosphere and a strikingly diversified scenery ; or retard bodily and mental development by unhealthiness, and an aspect of dreary monotonousness. It may contribute to train up a manly race, endowed with industry, ingenuity, and energy, by stringently connecting subsistence with labour, while attaching a rich reward to strenuous efforts, in regions favoured with temperate sunbeams and refreshing breezes ; or it may foster physical, intellectual, and moral enervation by a relaxing climate, with those ever-blooming landscapes where exuberant fertility renders cultivation superfluous, or divests it of all toil. Hence the philosophic historian duly estimates whatever is distinguishing in the localities of nations, while discussing their character and tracing their career.

It is unquestionably the case that the position of our territory, surrounded on every hand by the great highway of nations, the ocean, and at no point far distant

from its tide, along which products are readily received and exchanged with all parts of the world—a climate neither sultry nor severe—and vast stores of mineral wealth, not to be gained without the exercise of great industry, but, when won, forming the implements or materials of most important manufactures—are some of the main sources of British eminence. It is further true, that without a monopoly of natural advantages, there is no other district of corresponding extent, at present known, which possesses in such variety, abundance, and juxtaposition, the material elements of prosperity. Hence as nations have not been scattered at random, but have been planted by a controlling Providence, the British Christian will thankfully acknowledge the hand of God in casting his lot where nature offers so few impediments to personal comfort, and affords so many facilities for the various employments which provide subsistence to multitudes within narrow bounds, and seldom fail to realize a competent return to honest industry and integrity.

The history of our Island Home, in all its aspects, belongs almost entirely to the modern age. We have knowledge of various countries obtained from written documents and well-preserved monuments, which illustrate to some extent their condition at a very remote antiquity. This is the case with reference to the sunny regions on the shores of the Mediterranean and in the basin of the Euphrates—Italy, Greece, Phœnicia, Palestine, Egypt, Persia, Babylonia, and Assyria. But at the period to which such notices refer, Britain—at present perhaps the most popularly known country on the face of the globe—had no observer within the pale of civilization, and was either completely abandoned to

the bear, the wolf, and the beaver, overspread with forests of pine and oak, intermingled with impassable morasses, or was occupied by a few barbarian hordes, who had no concern about any object beyond the bound of their sensible horizon, except the game and fish that might be encountered and taken. Though its inhabitants received some slight notice before the Christian era, yet for many centuries afterwards, the chronicles of life within its borders are meagre of information, and long intervals elapsed without a chronicle at all. Its full and accurate civil history begins at a much later date, and the careful elucidation of its natural history is in some departments little more than half a century old.

It can scarcely fail to excite surprise to read the account given by Sir Joseph Banks of his visit to Fingal's cave in Staffa,—a locality now well-known by name and description to almost every school-boy in the kingdom, and regularly visited in summer by a steamer for the accommodation of tourists. He was in its neighbourhood in the year 1772, a date to which some existing lives go back, but had never heard of the great natural curiosity. Two resident landowners in the adjoining island of Mull seemed to know nothing of the place, or at least they did not deem it sufficiently wonderful to be mentioned to the inquisitive stranger. At last he encountered an Englishman, travelling like himself, who gave information of an island where he believed no one even in the Highlands had ever been, in which were pillars like those of the Giant's Causeway. This was enough for the enterprising naturalist, who immediately sought the indicated spot, explored its grand basaltic temple, took measurements, and drew up a report respecting its striking characteristics which

had been for ages unadmired and undescribed. Staffa is indeed mentioned by Buchanan, but only in a very cursory manner. Sir Joseph Banks was the discoverer, little more than eighty years ago, of this great attraction to the British public. In fact, at that period a very considerable portion of Scotland, the northern half, with its coasts and islands, was only indefinitely known to the southern as a region of wild mountains, bleak moors, dense mists, endless lakes, and bare-legged savages. Political and social circumstances had contributed to this non-acquaintance—such as the lawless state of the Highlands, and the want of roads—down to the pacification of the country after the rebellions in favour of the Stuarts, which was not fully effected till George III. was king.

Since the period referred to, and especially during the last half century, while knowledge has made prodigious advances with reference to the natural features of foreign countries, those of our own land have been carefully noted. Nor is there now any region respecting which such a comprehensive collection of facts of undoubted accuracy has been made in relation to its physical phenomena as in the instance of the United Kingdom. This result has been obtained by means of government surveys, the efforts of scientific bodies, and the enterprise of private individuals.

By the Ordnance or trigonometrical survey of the Kingdom, which has been completed in respect to Ireland, largely executed with reference to England and Wales, and in progress in Scotland, we have the details of the surface as to area, contour, and the position of places, exhibited with singular minuteness and accuracy. The results of the Irish survey, which commenced in the year 1825 and was finished in 1842, occupy the

very large number of 1,907 sheets of maps, the whole of which were engraved and published by the year 1846, at an outlay upon the whole work considerably exceeding three-quarters of a million sterling. These maps are on the scale of six inches to a mile, and each measures three feet by two. Their gross area amounts to 11,000 square feet; and if the several sheets were properly united and hung up, they would form a single monster map 180 feet wide and 140 feet high. The topography, industry, antiquities, and social arrangements of the sister island are graphically exhibited. The names and the boundary lines of counties, baronies, parishes, and townlands; the names and features of cities, market-towns, and villages; the localities of parish-churches, ruins, round-towers, forts, parks, mansions, and farms; of rivers, brooks, bogs, marshes, canals, bridges, and wells; of mines, quarries, collieries, lime-kilns, forges, and large factories are all delineated. This extraordinary representation of the surface could only be obtained originally at the cost of about 1,000*l.*; and even at the present reduced price, which amounts to about 200*l.*, it is quite out of the reach of the public, except in detached sheets which may be had for comparatively small sums.

The results of the survey of Great Britain have appeared with reference to England and Wales, the six northern counties excepted. They are given upon a far inferior scale, that of one inch to a mile, and occupy 90 sheets, which, if placed in their relative positions, would form a map 30 feet wide and 25 feet high. But the survey of the remaining portions is now proceeding on the larger as well as the smaller scale; and probably the southern portions of the island will ultimately be re-surveyed on the same enlarged plan.

A geological survey of the kingdom, now combined with the trigonometrical, shows by colouring on the ordnance maps and by independent sections, the general structure of the country, the boundaries of strata, their order and position, with the special view of promoting mining industry, and agricultural and manufacturing chemistry. It was commenced in the year 1832 under the superintendence of the late Sir Henry de la Beche, and has been completed as regards the south-western counties, portions of the midland, and the whole of Wales.

While the inorganic features of the surface have thus been examined, or are in course of examination, the phenomena of the atmosphere and the details of organic life within our borders have been studied with equal precision. By an annually increasing number of meteorological stations, established in connexion with the seats of the nobility and gentry, as well as by public authority, at suitable points, a mass of data has been collected in relation to temperature, the rain-fall, the force and direction of the wind, with other atmospheric conditions. Such details are not merely of interest to the scientific, but of importance to the practical purposes of life; for meteorology has an intimate bearing upon agriculture, navigation, and the multiform arrangements of society. These and similar observations in other countries, continued for a series of years, will form a foundation for important conclusions respecting the atmosphere, showing it to be obedient in all its changes to the rule of law, and not the emblem of caprice or uncertainty. The indigenous forms of animal and vegetable life have also been carefully described by professed and amateur naturalists, who have furnished a series of systematic works, admirably illustrated, de-

voted to the quadrupeds, reptiles, insects, birds, fishes, crustacea, mollusca, zoophytes, and other occupants of the land and water. From this ample stock of materials some of the more important and interesting particulars are gleaned in the following pages, which are designed to give a popular yet definite and comprehensive view of our Natural History in its various departments.

The British Archipelago is situated to the north-west of the European continent, opposite to the shores of France, Belgium, Holland, Denmark, and Southern Norway, from which it is separated by the English Channel and the North Sea. The nearest approach to the main land is made at the south-east angle of England, where the distance is only about twenty miles from Folkestone in Kent to Cape Grisnez in France. In clear weather the cliffs of Dover and Calais, with a long line of the two coasts, are respectively visible across the intervening waters; and in bright sunshine the chalk rocks on both sides of the strait are conspicuous objects. This visible proximity has been of no mean historical importance, for in all probability it stimulated the expedition of Cæsar to our shores, from which the introduction of civilization to Britain subsequently arose, with the first publication of Christianity to its inhabitants. With all his boldness, it is extremely unlikely, that the Roman general would have embarked his legions upon the deep had there been no apparent boundary to its billows, and if he had merely the reports of barbarian natives to rely upon, that there was land in the distance. But the prize being in view contributed to remove doubt from the adventure, and to lessen the fear of danger. The relation in latitude, of the insular to the continental territories may be shown

by naming a few places under nearly the same parallels, as Ramsgate and Ostend, Harwich and Rotterdam, Lowestoft and Amsterdam, Boston and the Texel, the mouths of the Humber and the Elbe, Berwick-upon-Tweed and Copenhagen, Aberdeen and Riga, Kirkwall in the Orkneys and Stockholm, Lerwick in the Shetlands and St. Petersburg. In the opposite direction, or westward, the Atlantic Ocean rolls upwards of sixteen hundred miles of open water between the shores of Ireland and Scotland and the coast of Labrador on the continent of North America.

The British Isles, including the Channel group, range from Jersey, the most southerly, in latitude $49^{\circ} 13'$, to Unst, the most northerly of the Shetlands, in $60^{\circ} 49'$, thus extending through 11 degrees. But the great proportion of the country, and the vast majority of the population have a much less latitudinal range. A line running along the 55th parallel, divides the islands into two portions of $5\frac{1}{2}$ degrees each, extending north and south of it. North of the line is the main mass of Scotland, with its dependent isles, and small sections of the north of England and Ireland. South of the line is the main mass of England and Wales, with nearly the whole of Ireland, and their bordering islets. The territory in the northern portion comprises about 21,500,000 acres, and in the southern 56,900,000 acres, while the populations on the north and south sides are respectively about 3,185,000 n., and 24,328,000 s.

Owing to difference of latitude, the sun, at the summer solstice, is three hours longer above the horizon at the northern extremity than at the southern. The midsummer day extends to about 16 hours in our southern localities, and to 19 hours in the most northern, leaving an interval varying from eight to five hours for

the length of our midsummer night. But this interval is, astronomically speaking, one of twilight only, for as the sun then dips to a comparatively small extent below the horizon, his rays continue to reach the upper regions of the atmosphere, and light is transmitted to us from thence by reflection through the whole period from sunset to sunrise. The interval is also very sensibly one of bright twilight, in favourable states of the weather, in the northern parts of the kingdom, owing to the depression of the sun below the horizon being less than in the southern. In the latitudes of Inverness, Wick, Kirkwall, and Lerwick, when the sky is tolerably clear of clouds, reading, writing, needlework, and other delicate occupations may be performed by the aid of the natural light, at hours which appear extraordinarily late to visitors from the south of England, even when the time-piece is marking the close of one day and the commencement of another. "At midnight," says a correspondent at Balta Sound in the Shetlands, "on the 21st of June, I have often read such print as 'Chambers' Edinburgh Journal.'" Little distinction is made by many of the feathered tribes between day and night. Mr. St. John, a naturalist, in the record of a tour in Sutherlandshire, remarks:—"The nights at this season are most enjoyable; in fact, there is no darkness. I went out of the inn at midnight, and was much amused at hearing the different cries of the birds. Close to the door is a small inclosed clump of larch, where the grass and weeds are very high and rank. In this little patch it seems that a sedge warbler had made her nest. All day long had the male bird been singing to his mate, and now at midnight he was still uttering unceasingly his merry note. Towards the loch a constant tumult was kept up among the waders and water-

fowl. High in the air was heard the common snipe, earning his Gaelic name of 'air goat' by his incessant bleating cry; while redshanks, curlews, golden plovers, and peewits, all seemed to be as lively as if it had been noon instead of midnight. Occasionally, too, both wid-geon and teal were heard to whistle each after its own peculiar fashion, and the quack of the common mallard was also constant. Now and then a note expressive of alarm was uttered by some bird, and immediately a dead silence was kept by the whole community for a few moments, but this was soon succeeded by greater noise than ever."

The fact of our summer nights being brief and bright was reported to the south Europeans in early times but with much exaggeration. It was one of the first circumstances in relation to northern countries of which the ancients had any knowledge. Pytheas, a Greek navigator of Marseilles, who flourished prior to the age of Alexander the Great, reached Britain, called Albion, or Al-fionn, that is, the "White Land," by the inhabitants. Following the southern and eastern shores, he arrived at Thule, of which he is said to have affirmed, that at the summer solstice the sun did not set for four and twenty hours. This place has been identified with Jutland in Denmark, where there is a district anciently called Thiu-land; also with the southern coast of Norway, a portion of which once bore the name of Thule-mark; and with our own Shetlands. But the statement is not true of these positions, or of any place without the arctic circle. Probably the Greek navigator heard of the phenomenon in relation to localities lying further north than those he visited, and ventured to apply it to the lands he saw, struck with the short and bright summer nights he actually

witnessed. Tacitus repeated the error. In his *Life of Agricola*, the historian remarks, that “in the farthest parts of Britain the nights are so clear that you can hardly tell when daylight begins or ends, and when the sky is not overcast with clouds, you may see all night long the light of the sun, which does not rise or go down, but moves quite round.” Pliny more correctly observes, “The longest day in Italy is of fifteen hours, in Britain of seventeen, where during summer the nights are clear.”

Our home islands lie between the meridian of $1^{\circ} 16'$ east and $10^{\circ} 30'$ west longitude. The former is that of Lowestoft Ness, on the coast of Suffolk; the latter that of the Blasquet islands off the coast of Kerry. There is thus a difference between the eastern and western points of $12^{\circ} 16'$ of longitude. This is equal to a difference of 49 minutes of time, for the sun appears to move from east to west over the length of one degree of longitude in exactly four minutes, owing to the rotation of the earth upon its axis from west to east. Thus the fishermen on the coast of Suffolk have sunrise and sunset 49 minutes earlier than the inhabitants of the western shores of Ireland. The lengths of the degrees of longitude vary with the latitude, diminishing as we recede from the equator towards the poles, where they converge to a point.

	Eng. Miles.
In lat. 0° , or at the Equator, a degree of longitude is about	$69\frac{1}{2}$
In lat. 50° , the extreme south of England, it is	$41\frac{1}{2}$
In lat. 54° , nearly that of York	$40\frac{1}{2}$
In lat. 56° , about that of Edinburgh.....	$38\frac{1}{10}$
In lat. 58° , the north of Scotland	$36\frac{1}{2}$

It will therefore be seen, that at the equator the sun appears to pass over sixty-nine and a half miles in four minutes, or rather more than seventeen miles in one

minute, at which rate the earth rotates in equatorial regions; in the south of England, the rate of rotation is forty-four miles in four minutes, or eleven in one; about the middle of Great Britain, latitude 54° , it is ten miles a minute, and in the north of Scotland nine.

Great Britain, the largest island of Europe, and the most important on the face of the globe, consists of two chief divisions, England and Wales on the south, and Scotland on the north. They formerly constituted politically distinct kingdoms, and are to some extent naturally distinct districts. The southern portion is the most extensive, level, and fruitful; the northern is smaller, more mountainous, and comparatively less fertile. They differ also vastly in their geological structure. Crystalline non-fossiliferous rocks prevail in the north, while the country to the south is characterized by the predominance of secondary and tertiary fossiliferous formations.

The entire island extends from Dunnet Head in Caithness, the north extremity of Scotland, lat. $58^{\circ} 40'$, to the Lizard Point in Cornwall, the most southerly part of England $49^{\circ} 57'$, and from Lowestoft Ness in Suffolk, long. $1^{\circ} 46'$ east to Arduamurchan Point in Argyleshire, $6^{\circ} 8'$ west. Owing to the general direction of the land being north by west, no line can be drawn, due north and south, intersecting the whole surface. The meridian of 2° w., which passes over the centre of England, from Poole on the Dorset coast to Berwick-upon-Tweed, scarcely touches Scotland at all. The greatest distance that can be travelled in a straight line without crossing any portion of the sea, is from south-east to north-west, or from Rye in Sussex to Cape Wrath in Sutherlandshire, an extent of 580 miles. The next greatest direct linear extent is from south-west to north-east, or from

the Land's End to Winterton Ness, in Norfolk, amounting to 367 miles. Due east and west, the greatest breadth occurs near the parallel of 52° , or between the Naze in Essex and St. David's Head in Pembrokeshire, which measures about 280 miles. The greatest breadth of Scotland is 146 miles, from Rowanmoan Point in Ross-shire to Buchan Ness in Aberdeenshire. But deep indentations of the opposite coasts remarkably contract the breadth of the whole island at various points. Thus between the head of Morecambe Bay in Lancashire and the mouth of the Tees, between Durham and Yorkshire, the distance is 70 miles; between the head of the Solway Firth and the coast of Northumberland, it is 62 miles; between the Firths of the Clyde and Forth it is 33 miles; and the north extremity of Scotland is almost insulated by the Dornock Firth on the east coast approaching within 24 miles of Loch Broom on the west.

The total area amounts to 89,644 square miles, of which 50,922 belong to England, 31,324 to Scotland, and 7,398 to Wales. An idea of this extent as a whole, and the relative size of the respective parts may be best conveyed by having recourse to simple geometrical figures. Thus adopting the figure of a perfect square, the area of England is equal to one of 226 miles to the side; Scotland to one of 177 miles; Wales to one of 86 miles; and the whole of Great Britain to a square of 299 miles to the side. Or adopting the figure of a circle, the area of England is equal to one with a radius of 127 miles; Scotland to one of 100 miles; Wales to one of 49 miles; and the whole of Great Britain to a circle with a radius of 169 miles. Caesar compared the form of the island to a triangle; and gave its circuit at 2000 miles. This amounts to little more than 1800 English miles, reducing the Roman measure to our own standard.

The resemblance is rude, but not very inapt. It has been commonly adopted, especially in relation to England and Wales, to which it is more appropriate. The estimate of the circuit is erroneous. Measuring the direct distance between the three points of the triangle--the apex at Dunnet Head and the extremities of the base line, or the Land's End and the South Foreland in Kent--the following is the result :

	Miles.
From Dunnet Head to the Land's End	600
From the Land's End to the South Foreland	520
From the South Foreland to Dunnet Head	510
	<hr/> 1,460

But the entire extent of the coast-line following the sinuosities, is vastly in excess of this measurement, and enormous in proportion to the area, though it cannot be stated with precision, owing to the want of actual surveys. In the annexed measurements, the inlets and estuaries have only been followed up to the termination of the broader parts of their openings.

	Miles.
<i>North Coast.</i> —From Cape Wrath to Duncansby Head	103
<i>East Coast.</i> —From Duncansby Head to the South Foreland	1,010
<i>South Coast.</i> —From the South Foreland to the Land's End...	418
<i>West Coast.</i> —From the Land's End to Cape Wrath	1,546
	<hr/> 3,112

The circuit of the island, as determined by the penetration of the sea, or the true salt-water coast-line has a far greater extent ; and the line of tidal influence has a still wider range. As an example in the above estimate, the estuary of the Thames is measured up to the Nore Light ; but the salt water comes up to Gravesend, and the tide ascends to Teddington, nearly nineteen miles above London bridge.

Ireland, to the west of Great Britain, is separated from it by the Irish Sea, St. George's, and the North

Channels. The opposite coasts approach within thirteen miles between Fair Head in the county of Antrim and the Mull of Cantire in Scotland. The nearest point to England is the coast of Down, about seventy miles from St. Bees Head in Cumberland; and the nearest to Wales is Greenore Point in Wexford, fifty-two miles from St. David's Head in Pembrokeshire. The north extremity of the island corresponds in latitude to that of the Coquet river at its mouth in Northumberland; and the south to that of Bristol. It has the general form of an oblique parallelogram, with the longest diagonal extending from Fair Head on the north-east to Mizen Head on the south-west, measuring somewhat more than 300 miles. But due north and south, the longest line, which coincides with the meridian of 8° W. extends about 230 miles, from Horn Head in Donegal to near Poole Head in Cork. In the direction east and west, the greatest distance is 180 miles, from Achris Point in Galway to the coast between Dublin and Drogheda; but indentations of the sea contract this breadth one half between Sligo and Dundalk. In fact, owing to the numerous bays and inlets on the coast, there is no part of the country more than fifty-five miles from the sea-mark. The area includes 32,531 square miles, of which upwards of 900 are covered with fresh-water lakes and rivers; and the length of the coast-line, embracing the estuaries as far as the tide penetrates, is more than 2,000 miles.

Whether we consider the position on the earth's surface, of the country we inhabit, or its relation to the great land masses of the globe, it is eminently true, that the Most High who divides "to the nations their inheritance," and determines the "bounds of their

habitation," has placed us in circumstances highly favourable to comfort, security, prosperity, and extended usefulness. We are removed from the scorching heat of tropical regions, and the stiffening cold of the arctic zone: and have the encircling ocean to moderate the warmth of summer, and render the winter comparatively mild by its uniform temperature. It is otherwise in continental districts, at no great distance from the sea, though under the same parallels of latitude, as the interior of Germany and Russia, where the extremes of heat and cold, according to the seasons, are excessive. Outbursts of volcanic force are not known within our borders, and our experience of the earthquake, of all natural events the most formidable and fatal to man, is limited to slight tremors of the ground. The winds roar, and the seas rage, lashed by the storm and tempest, but the atmospheric and oceanic disturbance, with the consequent peril to mariners and landsmen, is far less than in those regions which experience the full strength of the tornado and typhoon. It is manifest also, that while an insular site affords every facility for commerce, it is a strong security against foreign hostility, for immense difficulty and danger attend the passage of the sea by an invading army, in comparison with its march across the frontiers of continental kingdoms, which are commonly rivers, mountains, or mere artificial landmarks. Hence while most of the European capitals from Moscow to Lisbon, Berlin to Naples, have been occupied by foreign troops during the present century, no enemy has landed upon our shores. These favourable features of our natural position ought not to escape a distinct recognition; for though inferior elements of human advantage, and to be "counted as the small dust of the balance" in comparison with religious privileges and spiritual blessings,

they are highly important in themselves, and are the arrangements of a wise and bountiful Providence. "Who knoweth not in all these, that the hand of the Lord hath wrought this?" Not less evident is it that they place upon us the highest obligation to magnify him in his works, and "declare his praise in the islands."*

But while detached from the great continental masses, the British isles are peculiarly and influentially situated with reference to them. That hemisphere which contains the maximum quantity of land has its central point within our limits. It is commonly said to be London, but more accurately the point falls within a few miles of the port of Falmouth. This land-hemisphere, as it may be justly called, comprises the whole of Europe and Africa, all Asia and America, except the slender peninsula of Malacca, and the tapering extremity of the South American main. In the opposite water-hemisphere, the land is wholly insular, with the exception of the sites mentioned, and would be quite insignificant in extent were it not for Australia.

The fact under notice is not a little interesting so somewhat explanatory of our commercial eminence, and not a little significant in a religious point of view. "The earth is the Lord's, and the fulness thereof; the world, and they that dwell therein. For he hath founded it upon the seas, and established it upon the floods."† The Author of nature is one with the sufferer on the cross; and contemplates the subordination of all terrestrial arrangements to the grand object for which the Saviour died. "All things were created by him, and for him;—who is the beginning, the first-born from the dead;

* Job xii. 9; Isaiah xl. 15; xlii. 12.

† Psalms cxiv. 1, 2.

that in all things he might have the pre-eminence.”* Hence, our position in the midst of the peopled earth, easily communicating by its insular situation with distant countries and various nations, is one of no uncertain significance. It has not been assigned to us as vantage-ground merely for the purpose of acquiring material wealth, territorial aggrandizement, and political power, but as a station convenient to accomplish the high mission of radiating far and wide “the light of the knowledge of the glory of God in the face of Jesus Christ,”† with which we are blessed—that best of all illumination, derived from the word of truth, which, when applied to the understanding and heart by the Holy Spirit, leads the sinner to the Saviour, and through faith in him, finally conducts the child of sin and sorrow, renewed and reconciled, to a home in heaven.

* Col. i. 16, 18. † 2 Cor. iv. 6.

CHAPTER II.

THE SUBORDINATE INHABITED ISLANDS.

Number Unknown—Islands of England and Wales—*Holy Island*—*Ferne and Staples*—*Isle of Wight*—*St. Michael's Mount*—*Scilly Islands*—*Lundy, Anglesey, and Man*—Islands of Scotland—*The Orkneys*—*The Shetlands*—*The Hebrides*—*Inner Hebrides, or Tia Range*—*Skye, Jura, Eigg, Rum, Canna, Iona, and Staffa*—*Outer Hebrides, or Gneiss Range*—*Lonely St. Kilda*—*Arran*—*Ailsa Crag*—Islands of Ireland—*Rathlin, Tory, Achill, and Arran*—*Blasket Isles*—*The Skelligs*—*Channel Islands*—**Historical and Religious Associations.**

It is remarkable that the number of our home islands can only be conjecturally stated. Even of those scattered along the shores of England and Scotland which have long been occupied by man, the first accurate enumeration dates no farther back than the last census. On the morning of March 31, 1851, there was found and distinguished upon one hundred and seventy-five islands, a population dwindling down from the vast group of seventeen millions on the main land of Great Britain to solitary individuals on the subordinate sites. But this number of islands is exclusive of the inhabited isles of Ireland, the population of which is not discriminated by the Irish Census Commissioners from that of the adjoining shores. Including the Irish isles, with the sandy or craggy tracts of some considerable area, English, Scotch, and Irish, bare or scantily covered with verdure, which fishermen visit in their boats, shepherds occasionally dwell in during the summer, and sea-fowl occupy, and which have local names,—but excluding mere rocks,—

the total number of such insulated spots around the two masses of Great Britain and Ireland may be estimated at between one and two thousand.

ISLANDS OF ENGLAND AND WALES.

The isolated tracts scattered around the shores of south Britain, with the counties to which they belong, and the number of souls found upon them at the last census, are as follows :—

			Population.
<i>East Coast</i>	Holy Island . . .	Northumberland . .	908
	Parne and Staples . .	"	20
	Coquet	"	16
<i>South Coast</i>	Isle of Wight . . .	Hants	50,324
	St. Michael's Mount .	Cornwall	147
	Looe	"	7
	Scilly Islands . . .	"	2,627
<i>West Coast</i>	Lundy	Devon	34
	Barry	Glamorgan	4
	Caldy	Pembroke	86
	Skokam	"	6
	Ramsey	"	12
	Bardsey	Caernarvon	92
	Anglesey	Anglesey	57,318
	Skerries	"	9
	Hilbre	Cheshire	10
	Holme	Lancashire	8
	Chapel	"	3
	Peel	"	17
	Walney	"	306
	Man	—	52,341
	Calf of Man	—	43

The isle of Sheppey, in the estuary of the Thames, is not included in this enumeration, as it is merely a river island, separated from the main land of Kent by a narrow arm of the Medway. There are several other tracts on the coast of Essex, the south coast, and in the estuary of the Severn, omitted for the same reason. The isle of Portsea, on which Portsmouth is situated, answers more to the character of a peninsula; and the adjoining Hay-

ling and Thorney islands, in Chichester bay, are but slightly separated from the main shore. The isle of Portland has no pretensions to the name, being really a peninsula; and the isle of Thanet has entirely lost the appearance of insulation which it once possessed. The latter, in the age of the Romans, was divided from the rest of Kent by a channel, called the *Portus Ritupensis*, from two to four miles broad, which was the direct and customary route to London by sea. This breadth had become considerably diminished in the time of Bede, the eighth century, for he states, that it was but three furlongs wide, so shallow as to be fordable in two places, and hence called Wantsome, or the deficient water. But it was passable by light craft at the Norman conquest; and even so late as the fourteenth century, Twyne observes, "there be right credible persons yet living, that have often seen, not only small boats, but vessels of good burden pass to and fro." At present, the Stour, a river of very moderate size, after passing Canterbury some miles, divides into two branches, one of which flows northward as an insignificant brook to the estuary of the Thames, and the other runs southward to the sea between Ramsgate and Sandwich. Their beds represent the old ship channel which accumulations of sand gradually choked up.

The insular sites on the east coast of England are few and unimportant, and are confined to the Northumbrian shore. Holy island, the largest, is about nine miles in circuit, and two distant from the coast. But sandbanks render the passage of the intervening channel practicable to vehicles at low water, though it is dangerous to persons not familiar with it, and a circuitous route must be taken to avoid quicksands. Bede, a native of the neighbourhood, upwards of eleven centuries ago, refers

to this circumstance. "Which place," he remarks, "as the tide flows and ebbs twice a day, is enclosed by the waves of the sea, and again, twice in the day, when the shore is left dry, becomes contiguous to the land." The historian therefore terms it a semi-island,

"For with the flow and ebb, its style,
Varies from continent to isle."

This island, formerly called Lindisfarne, obtained its present name from having been a celebrated ecclesiastical site in the Saxon age, the seat of a bishopric, subsequently transferred to Durham. Eucrinites, fossil remains of lily-shaped animals, former inhabitants of the waters, occur in abundance among the rocks. As the circular stem of the animal consists of a number of articulated joints, with a central perforation, admitting of being strung together like beads when found detached, they are popularly called St. Cuthbert's beads, from an old superstition, that they were made by him while an ascetic resident in the vicinity.

"——— On a rock by Lindisfarne,
St. Cuthbert sits, and toils to frame,
The sea-born beads that bear his name."

The Farne and Staples islets, seventeen in number, form two groups, inner and outer, a few miles to the south-east, nearly opposite the basaltic headland of Bamborough Castle. The largest contains about twelve acres. They produce kelp and some scanty grass; and the down of the eider-duck, a winter visitor, is collected in considerable quantity. Thick fogs in calm summer weather; sunk rocks, some of which show themselves at low-water, while others lurk just beneath the surface; and strong currents in certain states of the tide, render the navigation difficult and dangerous. Coquet, off the

mouth of the river of that name, is a small tract of rich pasture, once the site of a fortress, now converted into a lighthouse.

On the south coast the Isle of Wight is separated from the mainland of Hampshire by the Solent, or the Solvent Sea—*Pelago Solcente*, the phrase of Bede,—and the great naval road of Spithead. The average breadth of the channel is less than four miles. But on the western side it is diminished to about one mile by a long narrow gravelly beach projecting from the main shore of the county, the extremity of which is occupied by Hurst Castle. The island forms an irregular rhomboid and has been compared to a turbot in shape. Its greatest extent is twenty-three miles from the Needles cliff on the west to Foreland farm on the east, by fourteen miles from West Cowes on the north to S. Catherine's Point on the south. The circuit is about fifty-six miles. It has been stated, and without undue national partiality, that Great Britain contains within itself, on a small scale, specimens of the grand and beautiful scenery of the whole of Europe. In a similar manner, all the more pleasing and picturesque features of Great Britain are to be found, within a narrow compass, in the Isle of Wight. The name is a corrupt contraction of the Vectis of the Romans, and occurs as Wecht, or Wiht, in Domesday Book.

A central range of hills and downs divides the island into two nearly equal parts, north and south. Its striking and distinctive features are in the southern division, commonly called "the back of the island." The coast here presents a continual succession of inviting or imposing scenes and interesting natural phenomena. There are towering cliffs, the projecting shelves of which serve as lodgments for prodigious numbers of sea-fowl in the

breeding season, caves hollowed at their base by the dash of the ocean, rocks, arched, needle-shaped, and fantastically moulded by the surge, and narrow chasms, locally called *chines*, cut and rent in the most extraordinary manner, apparently formed in the lapse of ages by the streams which descend through them from the high lands to the sea, as powerful torrents after long and heavy rains.

The most elevated point, St. Catherine's Hill, towards the south extremity, rises to the height of 830 feet. A "stern round tower of other days" remains upon the summit, which, after serving the purpose of a chantry, hermitage, and lighthouse, is now by day an excellent landmark to the seaman. It commands an extensive view, embracing the whole island, except one corner, with a long stretch of the coast of England from Portland Bill to Beachy Head; and in very clear weather part of the French coast near Cherbourg may be discerned. Immediately east of this point the beautiful Undercliff commences. This is a strip of the shore about six miles long and from a quarter to half a mile wide, remarkable for its wildly broken surface, presenting evidence of its having been formed by subsidence from the higher cliffs in the background. Being sheltered by the inland heights from northerly winds, its climate is genial, so that myrtles, geraniums, and various kinds of delicate evergreens endure the winter in the open air. But the boldest part of the coast-line is on the western side of the island, where the cliffs rise perpendicularly six hundred feet above the sea, and are the loftiest on the shores of England. Off the narrow west extremity the detached columnar Needle rocks are striking objects, five in number, though only three of them now project prominently out of the

water. In the same locality Alum Bay presents one of the most extraordinary of natural spectacles, being bounded on one side by lofty precipices of pearly chalk, and on the other by cliffs strangely but beautifully variegated with different colours, arising from the strata of clays, marls, and sands being impregnated with the oxide of iron. Deep purplish red, dusky blue, bright ochrous yellow, gray nearly approaching to white, and absolute black succeed each other, appearing from a distance as sharply defined like strips of silk or the streaks of a tulip, and after rain, the sun shining upon the cliffs gives a brilliancy to some of these colours rivalling the resplendence of real silk when strong lights are thrown upon it.

The rocky islet of Looe, on the coast of Cornwall, is off the estuary of the river of the same name. It was once crowned with a chapel, dedicated to St. George, now used as a coast-guard station. A similar spot is St. Michael's Mount, in Mount's Bay; this is connected with the main beach by a causeway nearly a quarter of a mile long, which is flooded eight hours out of twelve. It thus forms a semi-island, rising conically 250 feet above low water mark, and having a sea margin of about a mile in circumference. From remote times to a recent date the Mount was occupied by an anomalous establishment of monks, nuns, and soldiers, and was formerly visited by a great crowd of pilgrims as a peculiarly sacred place. It has now a castellated ecclesiastical structure at the summit, with a fishing village at the base. The site is of interest to the botanist from the presence of some rare plants; to the geologist, as composed of granite and slate, formations which exhibit striking phenomena at their junction; to the antiquary, as very probably

the Iktis of Diodorus Siculus, to which the Phœnician merchants traded for tin; and to the poet as associated with Milton's Lycidas.

The Scilly Islands are a compact group, about thirty miles west by south of the Land's End, and the same extent in circuit, almost entirely composed of granite. They are remarkable for their wild and lonely position, rising up from a very deep and stormy sea, with nothing between them and America but the rolling ocean. Nowhere are the forms more strange and striking than those into which the rocks have here been worn by the tempests of ages. The cluster includes from one to two hundred islets. Forty of the number bear herbage, twenty-seven have an area of an acre and upwards, but only six are inhabited. These are,

		A. res.		Pop.
St. Mary	. .	about 1600	. . .	1668
Tresco	. .	" 700	. . .	416
St. Martin	. .	" 550	. . .	211
St. Agnes	. .	" 300	. . .	204
Bryher	. .	" 300	. . .	118
Sampson	. .	" 80	. . .	10
				<hr/>
				2627

The rest are tenanted by rabbits, goats, gulls, and a large species of cray-fish. The inhabitants, who are chiefly fishermen, sailors, and pilots, have a saying illustrative of the dangers of their seas, that for "one man who dies a natural death nine are drowned." But this applies to former times. Improvements in their craft, with lighthouses, and other provisions to save life in case of wreck, have largely abridged the number of fatal accidents. The dangers arise from strong currents, thick fogs, frequent squalls, sunk rocks, and a heavy swell. On an average, there are said to be not more than six really calm days in the year, and wind and wet are the prevailing characteristics of the climate. The

islanders have sad tales to tell of maritime disaster—none more melancholy than that of the fleet under Sir Cloudesley Shovel in 1707, while returning from Toulon. Being drifted out of its course by the strong current produced by the indraught of St. George's Channel, the vessels came, in thick tempestuous weather, upon the rocks which form the south-western portion of the group. The admiral's ship, the *Association*, struck upon the Gilstone rock, and went to pieces in a few minutes; the *Eagle* and *Romney*, line of battle-ships, shared the same fate; the fire-ships *Phoenix* and *Firebrand* ran ashore. Two thousand persons perished upon this occasion. On the shore of Porth Hellick, "the cove of willows," in St. Mary's, the body of the admiral was picked up and buried, but was afterwards removed to Westminster Abbey.

The name, *Scilly*, is supposed by some to be derived from *Sallch*, an old British word signifying "the rocks consecrated to the sun;" and as seen at sunset from the Land's End, whence they are distinctly visible, they seem as if imbedded in the departing luminary. The islands belong to the duchy of Cornwall, and are leased to a Lord Proprietor, who resides in Treseco, but has Hugh Town in St. Mary's for the capital of his dominions. They include many oddly-named caves, rocks, and reefs, as the Piper's Hole, the Cow and Calf, the Hellwethers, Buzza Hill, the Dutchman's Carn, the Kettle and Pans, the Monk's Cowl, the Tooth Rock, Pitt's Parlour, the Pulpit Rock, the Hangman's Isle, and the Old Man cutting Turf. Not less curious is it to find such names as London and Bristol given to little groups of cottages. The natural herbage consists of thin short grass, intermixed with heath, dwarf-furze, fern, and moss. Timber and fruit trees are only found in a few sheltered spots in St. Mary's.

The minor detached sites of our western coast are devoid of interest, except Lundy, at the mouth of the Bristol Channel, where it opens as if to receive the rolling billows and clearer waters of the Atlantic. The island is less than three miles long by one broad, and is twelve distant from the nearest point of the shore of Devon. It is a sombre mass of granite, with slate at the south extremity, so guarded by steep or overhanging cliffs, and girded with insulated rocks, that according to a popular saying, "There is no entrance but for friends." This wild seclusion has had a small population from an early date. In the reign of Henry III. it was occupied by Sir William de Marish, who, having compromised himself at court, fled to the solitary stronghold, gathered a numerous band, turned pirate, and was long the terror of merchantmen in the Channel. Being captured by a stratagem, he was conveyed to London and executed with sixteen of his confederates. The French, in the reign of William and Mary, succeeded by guile in effecting a landing, and remained a few days, the lords of the islanders, their granite soil, and rabbit warrens.

Anglesea, on the north-west coast of Wales, and one of its counties, is separated from the principality by the Menai Strait, but has been connected with the main land by the mechanical genius of man by means of a suspension and a tubular bridge crossing the channel. The latter is a structure unrivalled in the annals of engineering enterprise. Previously to these erections, communication was maintained by ferries, and the herds of cattle exported were compelled to effect the passage by swimming. The strait extends about fifteen miles in length, varying in its width from two miles to two hundred yards. Anglesea, called Mona by the Romans, had

previously been distinguished by British names signifying the "shady or dark island," "the furthestmost island," and "the island of heroes." It received its present name, *Angle's ey*, the Englishman's island, from the Saxons. It is upwards of eighty miles in circuit, possesses great mineral wealth, and is of high public importance as the nearest and most convenient point of communication with Ireland. But its aspect is unattractive, it being comparatively flat, and deficient in woodland scenery.

The Isle of Man, in the Irish Sea, generally noticed in connexion with England, geographically belongs to Scotland, both by proximity and the direction of its mountain chain. It is about thirty miles from the nearest points of the English and Irish shores, and not much more than half the distance from Burrow Head, on the Scottish coast. Its greatest extent is thirty-four miles from north to south, thirteen miles from east to west, narrowing very considerably towards the northern and southern extremities, and the circumference is about seventy miles. A chain of mountains, composed of mica-slate and clay-slate, running through the island in a longitudinal direction, divides it into two nearly equal parts. Sneafell, the highest point, towards the centre, rises 2001 feet above the level of the sea, and on a clear day, portions of England, Ireland, Scotland, and Wales are visible from its summit. The island is called *Mona* by Caesar, *Monapia* by Pliny, *Monæda*, by Ptolemy, and *Menavia* by Orosius and Bede, names probably derived from the British word "*Mon*," which means isolated. The history of Man is very peculiar, and its position at present is not a little anomalous. After having passed under the rule of old British, Norwegian, and Scottish princes, it became subject to Eng-

lish nobles, from one of whom it descended to a Scotch duke, whose sovereign rights and patrimonial property were purchased by the British government in 1784. Yet though a considerable territory, with a large population, in the very centre of the United Kingdom, and on the ocean road between Liverpool, Glasgow, Belfast, and Dublin, it forms no part of England, Ireland, or Scotland, but retains judicial institutions and revenue laws peculiar to itself. The people are of Celtic origin, and speak a dialect allied to the Gaelic of the Scottish highlands, but English is generally understood, and in common use.

ISLANDS OF SCOTLAND.

North Britain includes a very large number of isolated tracts, of which some are of great extent, many are mountainous, and but few of much value. They are for the most part arranged in groups, each group consisting generally of a mainland or chief island, in the midst of subordinate adjuncts.

			Popu- lation.
<i>East Coast</i>	Inch-Cohn	Fifeshire . . .	1
	Inch-Keith	"	9
	May	"	18
<i>North Coast</i>	Stroma	Caithness . . .	211
	Roan	Sutherland . . .	48
	Mainland, or Pomona	Orkneys	16,668
	Adjuncts	"	13,722
	Mainland	Shetlands . . .	20,936
<i>West Coast</i>	Adjuncts	"	9,862
	Skye	Inner Hebrides .	21,528
	Adjuncts	"	32,278
	Lewis, and part of Harris	Outer Hebrides .	22,918
	Adjuncts	"	13,212
	Bute	Bute	9,551
	Arran	"	5,857
	Lamlash, or Holy Island	"	81
	Inchmarnock	"	35
	Great Cumbray	"	1,266
	Little Cumbray	"	9

The solitary inhabitant found at the census on Inchcolm, in the Firth of Forth, was a farm-labourer in charge of thirty acres of land. Only the great groups require notice.

The Orkneys, ancient *Orcades*, are situated off the north-east extremity of Scotland, or the county of Caithness, from which they are separated by the Pentland Firth, a channel about seven miles wide. They are sixty-seven in number, but only twenty-eight are inhabited, though several of the remainder are used as pasture-grounds. The unprofitable land in their area greatly exceeds the cultivable, and small lochs occupy a considerable extent of the surface. Rising precipitously from the sea they form level tabular masses, marked with few eminences or valleys. Pomona, the largest, commonly called the Mainland, extends about eighteen miles from south-east to north-west. Hoy, the most diversified, contains the highest point, an elevation of 1556 feet. Tremendous precipices form its western coast, off which the "Old Man of Hoy," a detached rock perforated by an arch at the base, is a remarkable object. Exposed to the winds and storms of the Atlantic, which assail the islands with fearful violence, it is only in a few sheltered spots on the leeward side, that trees or shrubs can be made to grow. This is the more singular as the trunks of large trees are not unfrequently found imbedded in moss and sand, indicating the existence of a natural forest in ancient times. The Orkneys, together with the Shetlands, were early seized by the Northmen, and remained subject to the kings of Norway and Denmark till the year 1468, when James III. of Scotland marrying Margaret of Denmark, the islands were given in pledge for part of the princess's

dowry, which never being paid, they lapsed to the Scottish crown. The inhabitants of both groups are of Scandinavian origin and formerly spoke the Norse language, but it has been long superseded by English. Relics of old usages remain, and monuments of pre-historic times are numerous, as the "Standing Stones of Stennis," the dwarfic-stone of Hoy, with Picts'-houses, as they are called, cromlechs, and tumuli.

The Shetlands, perhaps the *Ultima Thule* of the ancients, lie to the north-east of the preceding group, at the distance of nearly fifty miles, Fair Isle lying in the centre of the channel as a kind of half-way house. The cluster consists of more than a hundred members, of which twenty-seven are inhabited. Sheep and cattle are pastured on some of the others, while the rest are sterile masses of rock. There are no remarkable elevations. Roeness Hill, towards the north extremity of the Mainland, the loftiest point, rises to the height of 1476 feet. Though this island extends about sixty miles from south to north, and has a breadth in one part of twenty-four miles, its coast-line is so repeatedly indented by "voes" or deep bays, that no portion of the interior is more than three miles from the sea. The surface is wild and rugged, often dreary and desolate. But headlands towering over a boisterous ocean, with their summits lost in mist, and numerous caverns scooped in their sides by the billows, some beautifully light, and others stamped with gloomy grandeur, are highly picturesque features of the shores. The Shetlands have been appropriately described as "the skeleton of a departed country," only the harder and most indestructible rocks apparently having withstood the fury of the Atlantic waves.

The Hebrides, *Hebudes* or *Ebudes* of the ancients, are commonly called the Western Isles, because they lie along the western part of the main coast. They are upwards of three hundred in number, of which eighty-one are inhabited, and a hundred and fifty are of sufficient size to be marked on an ordinary map. The islands are mountainous and destitute of natural woods, though considerable spaces have been planted with a kind of vindictive alacrity since Dr. Johnson paid his famous visit, and sarcastically alluded to the paucity of trees. But as in the case of the Orkneys, oak-timber found in the bogs and marshes affords evidence of the existence of woods in ancient times. Their destruction is traditionally referred to the Danes, who harassed the shores during many centuries, and like the Romans in England extirpated the forests as far as possible, to deprive the natives of their fastnesses. The winds rapidly made havoc of the remainder, when exposed to their full play by the devastations of the invaders, especially the south-west winds, appropriately called in Cornwall, the south-west "shears." Their destructive influence is attested by the trunks lying generally in the direction from south-west to north-east. A vast portion of the surface of the islands consists of morasses and lakes, poor pasture ground, barren districts of shifting sand, peat-mosses, and kelp-shores, dry at low water. Yet some have highly-productive alluvial soil, as Islay; and Lismore answers to the meaning of its name, "the great garden." The mass of the population is found upon the coasts, houses being rarely met with more than a mile from the sea mark. The⁹ Hebrides once formed the patrimony of the "Lord of the Isles," whose rule extended over a considerable part of the main-land of Argyleshire, and who was at times prac-

tically an independent sovereign. The title became extinct in 1536, when Macdonald, the last who held it, died without heirs. From that time the heads of clans or lairds exercised sovereign rights, till their jurisdiction was abolished in the last century. It is curious to find in the island of Mull a small hamlet called Siberia. It obtained that name from being the place to which the laird of Coll banished his people from that island when guilty of crimes deserving exile.

The Hebrides consist of two ranges of islands, the Inner and Outer, as distinct in their mineral structure as in their position.

The Inner Hebrides are those which immediately adjoin the Scottish main, and are incomparably the most attractive. They include the large island of Skye, forty-eight miles long, by fifteen broad, belonging to Inverness-shire; Mull, Islay, Jura, Colonsay, and Tiree, of important size, portions of Argyleshire; and others of smaller dimensions celebrated for natural curiosities or historical associations. This range may be geologically styled the Trap Islands, as they are chiefly composed of basaltic or trap-rocks, frequently assuming a columnar structure, and forming grand elevations. In Skye, which has its name from the Danish *Skue*, "mist," the scenery is very magnificent. The Cuchullin hills, remarkable for their dark colour and peculiar ruggedness, rise to the height of 3000 feet, and girdle Loch Curuisk on the western side with an insurmountable barrier by their craggy peaks. Owing to the almost constant atmospheric moisture, the sides of these mountains are dark and damp; but there are thousands of thin silvery waterfalls coursing downwards, which occasionally catch the gleaming sunbeam, and throw cheerfulness over the prevailing sadness of the

scene. Struck with the sublime appearance of the locality, Sir Walter Scott said, "Burrowdale, or even Glencoe, is a jest to it." The conical mountains of Jura, called the "Paps," from their peculiar shape, are scarcely less elevated, and are well-known sea-marks. Three of the principal bear the names of Ben-a-Chaolais, "the mountain of the sound," Ben Sheemta, "the hallowed mountain," and Ben-an-Air, "the mountain of gold." But Ben More, in Mull, which attains the height of 3,168 feet, is the loftiest point of insular Scotland.

Among the small islands of the group, Eigg, a wild chaotic waste, interspersed with a multitude of pools, is remarkable for its "Scur," composed of black porphyritic pitchstone, shooting up in columnar precipices, the loftiest of which rises upwards of 1,340 feet above the sea. Rum, a huge pile of dark mountains, is famous for its breed of horses, originally introduced here by a vessel belonging to the Spanish Armada. Canna is celebrated for highly picturesque scenes, and a rock possessing magnetic influence, which affects the compass. But deviations of the needle, produced by the influence of rocks or land, are very common among these basaltic islands; and in many cases the influence is so extensive as to affect the ordinary variation of the compass out at sea. Iona is of interest from its ecclesiastical history, and Staffa owing to its natural cavern. Opening towards the ocean, and traversed by the waves to its extremity, the cave of Fingal, as it is popularly called, can only be reached and explored by boating. It consists of a lava-like mass at the base, upon which two ranges of basaltic columns rest, and support an irregular ceiling of rock. The entire length of the cave is 371 feet, the breadth at the mouth 53 feet, the height

at the same point 117 feet, and the depth of water amounts to eighteen feet, which is reduced to nine feet at the upper extremity. The grand dimensions and architectural style of the cavern, the twilight gloom, the transparent green of the water, and the echo of the splashing breakers combine to render the whole scene singularly impressive. *Llaimh-binn*, the Gaelic name of the spot, signifies the cave of music, and alludes to the varying sounds of the surge.

The Outer Hebrides form a range separated from the preceding by the channel of the Minch, which is twenty miles across at the narrowest part. They extend upwards of a hundred miles in a longitudinal direction, and are so closely united as to have received the popular name of the "Long Island." The principal components are Lewis and Harris, the largest and most northerly belonging to Ross-shire, and the two Uists, north and south, attached to Inverness. These are the Gneiss islands of the geologist, that rock being the predominant and fundamental material. They are seldom visited by the traveller, and present few points worthy of notice, for the external aspect of purely gneiss regions is in general excessively monotonous and uninviting. "Nothing," says Macculloch, "can be conceived less interesting, in a picturesque point of view, than the whole of this chain of islands. No serrated outline, no spiral summits, no angles nor abrupt faces, vary the appearance of the hills—one rounded and tame line separates them from the sky. No trees occupy the valleys, no waterfalls sparkle along the declivities; the cliffs have neither magnitude of parts, nor breadth of disposition; the shores of the numerous bays are uniformly low, and the sea-rocks have neither elevation nor form to compensate for the dulness of the interior country." But some of the

sea-lakes or land-locked arms of the ocean are remarkable for their sinuosities. Thus Loch Maddy, in North Uist, is comprised within an area of nine square miles, yet its shores have been found by measurement to exceed two hundred miles in length. A parish in Lewis, which extends eighteen miles in direct length along the shore, measures eighty miles following the windings.

Far "amid the melancholy main" lies the solitary St. Kilda—the outermost of the Outer Hebrides, and the most lonesome of our inhabited isles—often assailed with storms, covered with the salt spray swept up by the winds from the turmoil of the ocean, and so veiled with mists as not to be discernible a stone's throw from the towering shores. Yet it is sometimes lit up by the setting sun with magnificent effect, seeming to the spectator on a distant ship's deck like some huge volcano newly emerged from the deep, or the giant watcher of a region into which none may enter without challenge. Most persons are familiar with the name of this spot, for though seldom inserted on a map, it has been enshrined in our national poetry. Collins has written of Kilda's race,

"On whose bleak rocks which brave the wasting tides—
Hard is their shallow soil, and bleak, and bare,
Nor ever vernal bee was heard to murmur there."

Thomson has also made mention

"Of a craggy cliff, such as amazing frowns
On utmost Kilda's shore, whose lonely race
Resign the setting sun to Indian wilds."

Still there are but few who have any definite knowledge of the locality, and as it is one of the least visited portions of our home territory—a wild, grand, isolated, and primitive part of the kingdom—it merits description.

At the distance of about fifty miles west of the Outer Hebrides there are three islands, Hirta, the principal and only inhabited one, commonly called St. Kilda; Soy, about a mile to the westward; and Borre-ray, eight miles to the north. There are also ten or twelve insulated rocks adjoining, locally styled *stacks*, of great height, very nearly perpendicular, and for the most part inaccessible except to flocks of sea-fowl. They exhibit remarkable forms, among which that of a triangle, a church-steeple, and a vessel under sail are prominent. St. Kilda, the head of the group, extends between two and three miles from east to west, by one in the opposite direction, and is about six miles in circumference. It is composed partly of sienite, but more largely of a dark greenstone, not columnar, nor disposed in terraces, but spiry and irregular, producing a craggy, uneven surface. It rises 1,500 feet above the ocean, and appears as a mountain resting upon it, visible in clear weather from near the level of the sea when sixty miles distant. The margin exhibits the grandest rock scenery, and is so impracticable that there are only two points at which a landing is possible. The one is the Eastern or Village Bay, which leads up to the hamlet, a quarter of a mile from the shore, on the side of a steep hill. The other is M'Leod's Bay on the north-west. But it is not often that these two points are accessible at the same time, for when the one bay is free from surf owing to the wind blowing *from* it, it blows *into* the other bay and renders the sea too boisterous to attempt a landing. Conachan, the highest point of the surface, descends abruptly to the sea-margin, and forms a nearly perpendicular cliff, supposed to be the loftiest in Britain. There are several springs which never fail in the hottest months, one called *Tobir-na-slainnte*, the Well of

Health, and another Tobir na h'oige, the Well of Youth. The climate is mild, only very thin ice forming in the coldest winter nights; but, owing to the tempests of spray which deluge the island, garden vegetables are reared with difficulty. The islanders mainly depend upon their clouds of sea-fowl for subsistence.

The St. Kildans were officially enumerated for the first time at the census of 1851. There were forty-eight males and sixty-two females, or a hundred and ten persons grouped in thirty-two families. Of these there were thirty-three Gillies, twenty-three M'Donalds, twenty M'Quiens, thirteen Fergusons, nine M'Crimous, nine M'Kinnons, two Morrisons, and one M'Leod, all born on the island, except a woman imported from Sutherland. The men were returned in the schedule as farmers and bird-catchers, and some of the women as weavers in wool. It is a strange fact, that, little more than a dozen years ago, not one of the islanders could swim, notwithstanding their desperately perilous occupations.

In the Firth of Clyde, the islands of Bute, Arran, the Cumbrays, and a few small tracts, form the county of Bute. Arran, the largest, twenty miles long by half that number broad, is one of the most interesting natural portions of the kingdom, presenting a more varied display of geological phenomena than any other district of the same extent. The surface, generally high, is mountainous in the northern part, and the scenery sublime. Granite here protrudes above the stratified formations of mica-slate and sandstone, and forms a group of grandly picturesque serrated heights, distinguished by their spiry forms, stupendous precipices, and general destitution of vegetation. Goatfell, or *Gaodh Bhein*, the Mountain of Winds, is the loftiest,

rising 2,865 feet, with an obtuse pyramid of granite for its summit, consisting of large blocks completely barren, or scantily spotted with lichens. In the southern part of the island the old red sandstone is the predominating rock. But this is penetrated by numerous trap veins of very varied composition. Dark porphyry with metallic diallage, black porphyritic greenstone, earthy greenstone, and claystones with nodules of green earth, are at various points closely aggregated; and Macculloch has enumerated in this single spot not less than twenty-six varieties of pitchstone. Southward of Arran, the rock of Ailsa rises abruptly from the sea upwards of a thousand feet. This is the most unique of our insular eminences, almost perpendicular on one side, everywhere steep, uninhabited by man, but tenanted by vast flocks of wild-fowl. Its height and isolation render it a very striking object from the coast of Ayrshire, and to passengers sailing to and from Glasgow.

ISLANDS OF IRELAND.

The east coast of Ireland corresponds to the east coast of Great Britain in having very few islands. They are, however, numerous on the west, north-west, and south-west shores, in most instances at an inconsiderable distance from the main land, and in general thickly peopled. The number has not been ascertained, but it is generally stated at about two hundred, of which nearly three-fourths are inhabited. A few of the larger class may be noticed, proceeding from north-east to south-west.

The crescent-shaped Rathlin island, six miles from the coast of Antrim, is celebrated for its basaltic columns,

analogous to those of the adjoining Giant's Causeway on the main shore. The inhabitants, a primitive and harmless race, are remarkable for their extreme attachment to their insular home. One of their worst wishes to any neighbour is, that he may end his days in Ireland; and one of their greatest grievances is to be compelled to pay the county cess for the repair of roads they never travel, and the maintenance of a jail they have never seen. In the intervening strait, the phenomenon of the mirage is often observed similar to the Fata Morgana of the strait of Messina, and is to be accounted for on the same principles. These singular optical illusions, called in the Irish language *Duna Feadhreagh*, or Fairy Castles, originated the stories respecting green islands rising out of the sea, and enchanted islands floating on the ocean, which are found in the old chronicles of the country.

Tory island,—the name being a corruption of the word tower,—ten miles from the wild shores of Donegal, is an object of great interest. On approaching it from the main, it has the appearance of an extensive castle in ruins, the rocks which represent its walls rising perpendicularly from the depths of the sea. On the opposite side the shores are low; and strong north-westerly gales, which are common, have been known to drive the waves over the whole flat part of the island, destroying the corn, washing the potatoes out of the furrows, and turning the springs of fresh water into salt. Yet the inhabitants very rarely leave the spot. Not many years ago, a fishing-boat containing seven or eight men, being driven by stress of weather to the adjoining coast, it was found that not one of them had ever been in Ireland before. The trees excited the utmost astonishment; and they were seen putting leaves and small twigs into

their pockets to show to their friends on their return. Achill, belonging to the county of Mayo, and containing about 35,000 acres, is the largest of the Irish islands, and is mountainous, wild, barren, and boggy. It has its name, which signifies "eagle," from the number of those birds by which it is frequented. The three south isles of Arran lie across the entrance to the bay of Galway, and guard it as a natural breakwater from the fury of the Atlantic. They are remarkable for containing monuments of a race which departed before history began its tale—cyclopean stone fortresses—some of the most magnificent barbaric erections remaining in Europe.

The Blasquet isles, thirteen in number, are the most western points of the British Archipelago. They are separated from Dunmore Head in Kerry by a sound of great depth, probably caused by the violence with which the tidal currents rush through it. One of the ships belonging to the Spanish Armada was wrecked on these rocks. The gourdlet, a delicate bird, which is compared to the ortolan, is peculiar to them. Valentia island, on the southern side of the entrance to Dingle bay, may be mentioned for its extreme fertility, and from its having been occupied by the Spaniards down to the time of the Commonwealth, when they were expelled by Cromwell. The Skelligs, two of the most extraordinary objects on our shores, little known, and rarely visited by strangers, lie to the south. The Great Skellig, nearly a thousand feet high, rises out of the ocean like the peak of some vast submarine mountain, as sharp as an Alpine *aiguille*, and as elegant and beautiful in form as can well be conceived. It stands about eight miles out to sea, sufficiently far from the coast to encounter the Atlantic in its wildest moods, before the force of its waves has been checked by the shallows and other obstacles which

usually occur near the land. The rock is a schistose mass, with the strata nearly vertical; and seems at a slight distance perfectly inaccessible. Landing is indeed impracticable except in very calm weather. Here, as early as the sixth century, some monks established themselves, whose cells remain remarkably well preserved. The *Annals of Innisfallen* mention an abbot of Skellig who died in the year 885; and soon after that period the mighty pinnacle was abandoned as an untenable regular habitation. The present inhabitants are the attendants upon two lighthouses, erected there at a vast expense, who are often in winter cut off for months from all communication with the shore. These lights are the first seen by vessels coming across the Atlantic. The keepers state, that during great storms, it is dangerous to stand at a lower level than a hundred and seventy feet above the sea. The Lesser Skellig, a sister isle, is lower, but more sharply depicted, and more difficult of access. It has never been occupied by man, but is known to naturalists as one of the six breeding stations within the limits of our islands of the gannet or solan goose. Cape Clear island, in Cork, marks the extreme south point of Ireland. The Capers, as the inhabitants are called, like the rest of their insulated countrymen, regard a sojourn on the main land with invincible repugnance.

THE CHANNEL ISLANDS.

Six islands in the bay of Avranches, geographically belonging to France, are the only relics of the extensive domains which our sovereigns once possessed across the channel. But though subject to the English crown, they are not, unless specially mentioned, included in

acts of the imperial parliament. Corrupt French is the language of the lower classes; pure French is observed in all judicial and public proceedings; but English is adopted in educated society, and is in some degree generally understood. These islands are,

	Population.
Alderney	3,333
Guernsey	29,787
Sark	500
Herm	46
Jethou	3
Jersey	57,620

The islands are almost entirely of granitic formation; and are surrounded with rocks, some of which are always exposed, others only at low-water, while many are permanently submerged. These rocks, with the strong currents and eddies they cause, render the approach difficult and dangerous to those who are not intimately acquainted with the navigation; and have contributed to preserve this isolated part of the British dominion from attack in times of war. The climate is variable, but mild; snow rarely falls, and never lies long upon the ground; frosts are seldom severe or continued; but rain is frequent, and the dews heavy. Flowers and fruits, wild and cultivated, are of the finest description. The chaumontelle pear arrives here at a degree of perfection as to size and flavour which it attains nowhere else. A peculiar breed of cattle, known as the Alderney, but more properly Jersey, largely exported to England, is so highly esteemed, that the importation of any other kind into Jersey is strictly prohibited, in order to keep the stock pure. No venomous reptiles are known; but toads and moles are numerous. Our red-legged partridge is from Guernsey; but it is now rarely seen in the group.

ALDERNEY, about twelve miles in circuit, the third island in point of size, is the nearest to England, being fifty-five miles to the south of Portland Bill; and the nearest to France, only seven miles to the west of Cape La Hogue. The intervening channel, dangerous in stormy weather, owing to strong eddying currents, is hence called the Race of Alderney. The second in rank, GUERNSEY, has a circuit of about thirty miles. The smaller islands are situated near it, and possess considerable natural interest. SERK has a rocky coast, indented on every side with small bays, locally called *boutiques*, or shops; and is so inaccessible, that there is no possibility of landing, except by scaling the cliffs, or ascending at one point by a tunnel cut through the rock. HERM is remarkable for its shell beach, extending from half to three quarters of a mile, composed of small perfect shells, and fragments of larger ones, without the least intermixture of sand or pebbles. JETHOU, scarcely two miles round, composed chiefly of gneiss, is the property of government, having been purchased for purposes connected with the construction of a harbour of refuge. JERSEY, the largest, most commercially important, and attractive of the islands, extends in the form of a quadrangle, about ten miles from east to west, by seven from north to south. It has numerous bays remarkable for placid beauty, and well-wooded and watered glens of extreme loveliness. On the west, the side most exposed to the violence of storms, there is an extensive tract, once highly fertile, but now absolutely barren, having been covered with sand raised from the shore by a tremendous tempest about three centuries ago.

Several of our minor insular dependencies have interesting historical and religious associations, while others have been the scenes of dismal tragedies. The Saxons

made their first formidable landing in Thanet, then separated from the main land of Kent by an arm of the sea. The Northmen or Danes seized the Shetlands and Orkneys, with the adjoining shores of Caithness and Sutherland, their *southern land*; and made them the great centre of their piratical expeditions, wandering down the east and west coasts of Great Britain to France and the south of Europe. In general, the sites terminating in *ey*, *ay*, *a*, "island," and *ness*, "promontory," as well as others, bear names which the Northmen gave them. Rollo, from whom William the Conqueror was the fifth in descent, was for some time in the Orkneys before he proceeded to attack Normandy. In Lundy, the feeble Edward II. endeavoured to shelter himself from his troublesome wife and rebellious barons. Rathlin afforded a refuge to Bruce in his misfortunes, and still contains the ruins of the castle where the interesting incident of the spider occurred, which has afforded such a useful example to mankind. The Scilly and Channel groups were the last strongholds of the royal cause in the great civil war; and the Bass rock has the unenviable distinction of being the last place on which the standard of the Stuarts waved at the Revolution.

In bygone times, it was not uncommon in the Hebrides for isle to be at war with isle, they being occupied by different clans between whom some deadly feud subsisted. Painful memorials exist of this unhappy social state. A cavern in Eig island, spacious in the interior, but so contracted at the mouth as only to be entered on hands and knees, has its floor strewn with fragments of human bones, the remains of some of the wretched inhabitants who took refuge in it from the Mc Leods of Skye, and were smoked to death by their infuriated foes. How striking the contrast between the past and the

present condition of society among us. In no part of the kingdom are the charities of home and neighbourhood more respected now than in its northern sites; and nowhere is there a people more humble, patient, and tractable than the descendants of the fierce clansmen of a former age. The change has not been wrought by human education, or the force of law, but by the influence of the gospel of Christ, the only effectual agent in turning men from turbulence, violence, and wrong, controlling the passions, and reforming the character—the only true civilizer of nations.

Anglesey and Man, both known under the name of Mona to the Romans, were the seats of the druidical hierarchy and worship. Iona, originally a similar site, became, in a dark age, the station of Columba, a man of apostolic spirit, exemplary conduct, and comparatively pure doctrine, who trained an order of missionaries in the “isle of his heart,” and sent them forth to diffuse the light of Christianity over northern Britain. Holy island, or Lindisfarne, which was occupied by one of his disciples, maintained much the same relation to northern England in the early Saxon times. Here the Durham Book, a copy of the Gospels in Latin, was written. It is preserved in the British Museum, and is a remarkably fine specimen of penmanship. The day of small things is not to be despised, nor should it be forgotten in after times by those whose epoch is more illustrious. At a period when the darkness of idolatry still brooded over many parts of the land, and Christianity was chiefly known as disfigured by Romanism, it was a step in advance to have centres, however few and small, from which the light of truth could be diffused. On this account, great interest attaches to such spots in the esteem of a rightly judging and more favoured poste-

city; and the men who were "otherwise minded," in relation to their benighted or perverted contemporaries, are entitled to honourable commemoration. At the same time, it is serviceable to compare our own opulence in religious means with the scanty opportunities of by-gone generations. Hereby we are reminded of the debt of gratitude we owe to the great Disposer of our lot, and of the obligations which devolve upon us, as accountable beings; for the degree of personal and national responsibility corresponds to the measure of advantage bestowed, and the sphere of duty expands in proportion as means and facilities for discharging it are accumulated and conferred.

CHAPTER III.

THE SEAS AND SHORES.

Relation of Inland Sites to the Sea—Effect of improved Locomotion—The North Sea—Extent, Depth, and Sandbanks—The Coast-line—Flamborough Head—Bass Rock—Duncansby Head—The English Channel—Hurst Castle Shingle Bar—Chesil Bank—Mount's Bay—Land's End—The Irish Sea—The Atlantic—Depth near the British Isles—Force of Waves—Marine Caverns—Tides of the British Seas—History of a Tide—Tidal Rise—Tidal Rivers—Opposite Currents—Whirlpool of Corryvreckan—Grandeur and Dangers of the Deep.

THERE are tribes and nations situated thousands of miles away from the ocean's rim, while others, geographically nearer, are separated from it by scarcely passable deserts, morasses, and forests, or by ranges of towering mountains. Such nations may hear of the deep waters rolling in distant grandeur; but they have no opportunity of gazing upon the mighty billows, without which no adequate conception can be formed of their wonderful features and apparent boundlessness. But the greatest distance to which any part of our home territory is removed from the sea-mark, very slightly, if at all, exceeds a hundred miles; and this applies only to a small area of the country on the confines of the counties of Northampton and Warwick. The greatest proportion of the surface of England, with the whole of Wales, Scotland, and Ireland, is within fifty miles of the salt-water line. Still, in the days of our forefathers, when roads were trackways, marauders were many, and public vehicles were wanting, it was a very bold adventure to compass this distance, and it was only attempted,

in general, by a few of the more enterprising traders, who formed themselves into a caravan for mutual protection, or by barons and knights in the company of their retainers. Even at a comparatively recent date, within the memory of many of the present generation, owing to the cost of travelling, and the time consumed, the mass of burghers and yeomen in our midland counties lived and died without sensible evidence of having an island home, while to the rustic and artisan population a journey to the shores was far beyond their means and calculation.

The marvellously improved facilities of locomotion in the present age have vastly altered this social condition. Their cheapness and rapidity place it within the power of the lower classes to accomplish distances which, in the days of their grandsires, were only traversed by the opulent; and practically our most inland districts have been rendered by the railway system as maritime as those were considered half a century ago to be which are within thirty miles of the beach. This is an advantage of no mean importance to the community. A temporary transition from interior localities to the immediate neighbourhood of the ocean is, as all experience proves, useful in many cases of disease, invigorating to the body, and a most agreeable mode of indulging in relaxation. It opens to the inland dweller a new chapter of the great book of creation, and enlarges his conceptions of the might and majesty of its Author. So illustrative of the Eternal Power and Godhead is the expanse of the ocean, that the inspired penman affirms of those that go down to the sea, "They see the works of the Lord, and his wonders in the deep"—as though their demonstrations on the land were comparatively less striking.

The British seas include an eastern, southern, and central basin, or the North Sea, the English Channel, and the Irish Sea, with the vast Atlantic Ocean, on the west and north, of which they are inland extensions.

THE EASTERN BASIN.

The North Sea, commonly but improperly styled the German Ocean, forms a kind of Mediterranean or close sea, between the eastern shores of Great Britain and the mainland of Europe. It extends through ten degrees of latitude, from the strait of Dover to a line joining the northernmost of the Shetlands with the coast of Norway at the Sogne Fiord, a length of about 700 miles from south to north. The breadth is rather more than 400 miles where the greatest expansion occurs,—between St. Abb's Head, on the coast of Scotland, and the Ringkiöbing Fiord, on the opposite shore of Denmark. The area is computed at 214,000 square miles, which exceeds that of the Baltic, or of the Black Sea. The greatest depth is on the Norwegian side, where the soundings give from 100 to 190 fathoms; but the mean depth of the whole is stated by Mr. Stevenson to be only about thirty-one fathoms. Notwithstanding the irregularity of the depth from the occurrence of numerous sandbanks, it increases generally as we proceed from south to north. A longitudinal section coinciding with the meridian of 3° E., which intersects the centre, gives the following results:—

			Fathoms.
Central depth in the latitude of	Yarmouth	.	18
"	Flamborough Head	.	24
"	Tynemouth	.	17
"	North Berwick	.	40
"	Tarbet Ness	.	50
"	Lerwick	.	90
"	61°	.	120

Transverse sections, taken at various points, show that from west to east the depth varies considerably. But there is generally a greater depth of water on the west and east sides, except close in shore, than in the central parts; and the water is deeper on the British than on the continental shores, the coast of Norway excepted.

Great accumulations of debris encumber the bed of the basin. Of these, the Dogger Bank, situated in the centre, is by far the largest. Its western extremity is about thirty miles off Flamborough Head. From thence, it extends eastward upwards of 300 miles towards the coast of Denmark, where it terminates almost in a point, though in various places not less than sixty miles broad. Midway a great branch diverges from it, nearly due north, under the name of the Long Bank. This vast shoal is a noted station for the cod fishery, frequented by Dutch and English fishermen; and as the shoalest part has nine fathoms of water, it presents no difficulties or dangers to navigation. Another great bank, known to mariners as the Long Forties, extends upwards of a hundred miles in a north-east direction from the mouth of the Firth of Forth. A considerable number, of inferior dimensions, some of which are partly dry at low-water, line the shores to the south of the estuary of the Humber, among which the Goodwin Sands have acquired an unhappy notoriety for the numerous and fatal shipwrecks of which they have been the scene. These sands extend about ten miles along the coast of Kent, at the distance of from four to six miles from it, and form a kind of natural breakwater, protecting the intervening channel, or the roadstead of the Downs, from the easterly gales. It is supposed that they once formed part of the Kentish mainland, from which they were separated and submerged by tremen-

dous storms, about the end of the reign of William Rufus, or the beginning of that of Henry I., after the previous tempests of ages had weakened the bond of union. The sands consist of two principal portions, divided by a narrow channel, navigable for small boats. Considerable spaces are left bare upon the recession of the tide. They then become quite hard, so as to admit of landing on them, but immediately loosen as soon as the tide returns to cover them. The largest of these tracts is known to seamen by the name of Jamaica island. Altogether, from a vast number of observations and comparisons, Mr. Stevenson estimates the average height of the sandbanks of the North Sea at about 78 feet, their superficial extent at upwards of 27,400 square miles, and their solid contents at no less than 2,241,248,563,110 cubic yards—equal to 28 feet of the whole of Great Britain in perpendicular height or depth, supposing its surface to be a level plain.

The British part of the coast line is marked with several considerable inlets—the estuaries of the Thames, the rivers of the Wash, and the Humber, with the firths of Forth, Tay, Moray, Cromarty, and Dornoch. It is nevertheless deficient in really good harbours, not one existing through its whole range, except London and Harwich, till we come to Cromarty firth, towards the north extremity. It presents some extensive projections, such as the angular district terminating at Kinnaird's Head in Scotland, and the rounded protuberance formed by our most easterly counties, Norfolk and Suffolk. The outline of the coast is however far more regular than on the western side of the island. South of Flamborough Head, the shores have for the most part a tame appearance, consisting of low cliffs of clay or chalk, flat marshy lands, and sand hills or sandy

levels; and the spires or towers of churches are frequently the only distinguishable landmarks to the seaman. But north of the promontory mentioned, a bold and rocky character predominates. Great changes have occurred since the date of authentic history, the sea gaining upon the land in various places, and the land gaining upon the sea at others. A submarine forest, which has been traced for several miles along the shore of Fifeshire, and another, visible as far as the limits of low water on the low shore of Lincolnshire, commemorate the former existence of dry land in those places, while spacious estuaries and channels, at other points, where ships once sailed, have been silted up, and converted into cultivable tracts.

The coast has several sites of interest either from their position or aspect,—as the South Foreland, at the south-east angle of Kent, a high range of chalk cliffs abounding with samphire; and the North Foreland, at the north-east angle, a similar range, but lower. Both have lighthouses to warn mariners of their approach to the intervening Goodwin Sands; and are passed at no great distance by more shipping than any other points on the face of the globe. Flamborough Head, on the Yorkshire shore, is a far more striking object, and one of the boldest promontories of England; not so much on account of its height, as of its far advance into the sea. The name, signifying the “headland with the flame,” is said to be derived from a beacon-fire for the service of navigators, kept alight there in the times of the Danes, with whom it was a favourite station. The brilliantly white chalk cliffs of which it is composed form a range nearly six miles long, and in some places rise to the perpendicular elevation of 300 feet from the sea. They are visible far out upon its surface, and

serve during the day as a signal post for ships, except in hazy weather ; while a revolving light flares from the extremity by night. Caverns hollowed out at the base of the rocks by the lash of the waves, with their floors smoothed by the attrition of the tide, are haunted by immense numbers of sea-fowl.

" O Flamborough, whose solitary light—
 To vagrant mariners a welcome sight—
 The Christian's star portrays, be thou my theme.
 When dark-brow'd night succeeds the brilliant day,
 And heaven's own lamps extinguished are in sky,
 The bark securely steers her watery way ;
 Thy beams celestial cynosure supply ;
 As erst that orient star's auspicious ray
 The magi guided on their mission high."

Proceeding northerly we come to St. Abb's Head, in Berwickshire, high and bold, one of the eastern extremities of the Lammermoor Hills ; and to the Bass rock, near the entrance of the Firth of Forth, two miles from the shore of East Lothian.

The Bass, a remarkable pile of natural architecture, is a mass of granular greenstone, rising precipitously from the sea to the height of 420 feet, with only one point where it is possible to land, on the side opposite to the main shore. The rock is nearly round, and about a mile in circumference. It formerly possessed a small fortress, often used as a state prison, in which many of the leading Covenanters were confined, during the struggles of the Scotch against episcopacy. Though the building is dismantled, the dungeons in which they were immured remain entire. A spring on the summit supplied the garrison with water. The only occupants now are a few sheep, pastured by the tenant, who resides on the mainland, and vast numbers of solan geese, who here spend the breeding season, and are captured chiefly for the sake of their feathers. It is remarkable

that this is the only spot on the east coast of Britain which the solan frequents. Twelve birds, with their feathers on, are annually paid to the minister of North Berwick as part of his stipend.

Rugged cliffs, often cavernous, with intervening low sandy tracts, distinguish the remainder of the east coast of Scotland. It has grand features towards the north extremity, where the mountains come down to the water's edge, as at the Ord of Caithness, and terminate in stupendous precipices. Duncansby Head, the extreme north-east point of the island, is a mass of confused red sandstone strata, perforated by the sea in different parts, with several "stacks," or detached rocks, in front, detached from it by the action of the waves. About a mile and a half to the west of this headland, the site and foundations of the famous John O'Groat's house are shown, erroneously supposed to have been the most northerly dwelling on the mainland. The name is a corruption of John de Groot, a Dutchman, who, according to tradition, settled here about the reign of James IV., and arranged a dispute among his nine sons upon a point of precedence, by opening nine doors in his house, assigning one to each, by which means they passed in and out without quarrel. The most northerly dwellings on our main shores are in the neighbourhood of Dunnet Head, a little to the north-west.

THE SOUTHERN BASIN.

The English channel, separating England from France, extends somewhat more than 300 miles in length, from the strait of Dover to a line connecting the Land's End with the island of Ushant, where it meets the Atlantic.

Westward from the narrow strait it rapidly expands in breadth, and is upwards of 110 miles wide at the oceanic extremity. The shallowest part follows a line drawn between Romney marsh and Boulogne, but from thence the depth progressively increases towards the ocean. This line, at the western entrance of Dover strait, may therefore be regarded as the point of partition between the two great inclined planes forming the bottom of the Channel and of the North Sea. There is generally a greater depth of water on the English than on the French side; and our ports and harbours are superior to those of our neighbours. Along the counties of Kent and Sussex the coast is tolerably regular; and contains the lowest and highest points of the entire shore. Romney Marsh, the former, a large tract of land between Dungeness and Hythe, has been reclaimed from the sea, and is only preserved from submergence by the embankment of Dymchurch Wall, originally constructed by the monks in the middle ages. Beachy Head, the latter, nearly midway between Hastings and Brighton, 564 feet in height, is formed of chalk cliffs that overhang the beach, whence it derives its name. Successive falls of rock have vastly reduced its dimensions. In the neighbouring cliffs caverns have been excavated, to serve as places of refuge for shipwrecked mariners.

Towards Hampshire the coast becomes sinuous, forming the inlets of Portsmouth harbour, Southampton Water, Studland Bay, and Weymouth harbour, with the three broad openings of West Bay, Plymouth Sound, and Mount's Bay, each comprising minor indentations. Hurst Castle Shingle Bar, and the Chesil Bank are natural curiosities of the shore; the Lizard Point and the Land's End are the remarkable promontories.

The Shingle Bar is a low narrow tongue of land projecting from the Hampshire coast towards Clevesend point in the Isle of Wight. It consists of rounded chalk flints, with other pebbles intermixed, derived from the waste of the Hordwell cliffs to the westward, and forms a sterile causeway about a mile long, seventy yards broad, and twelve feet high. In the great storm of November 23, 1824, the bank was moved bodily forward for forty yards towards the north-east. It appears that along the whole of our south-coast, the shingle has a general eastward movement, from Cornwall towards Kent, the tides and currents from the Atlantic driving it before them. Hurst Castle, erected in the reign of Henry VIII., one of the prisons of the unfortunate Charles I., stands at the extremity of the bar. The passage between the mainland and the island is narrowed by this projection from two miles to less than one, and has acquired great depth owing to the immense force with which the tide rushes through the contracted channel.

A similar but far more extraordinary ridge is the Chesil bank, connecting the so-called isle of Portland with the mainland of Dorset. It runs in a remarkably straight line north-west from Portland, parallel to the coast, from which it is separated by a narrow arm of the sea, called the Swannery Fleet, from the immense number of swans that harbour in it. It extends as far as Abbotsbury, where it joins the shore, a distance of ten miles. The bank is in some places nearly a quarter of a mile wide, but commonly much less, and has its name from the German *Kiesel*, a pebble. The base is a hard blue clay, which is covered to the depth of from four to six feet with a coating of smooth round pebbles, chiefly of white calcareous spar, but partly of quartz,

chert, and other materials. So loose are they, that a horse's leg sinks almost knee deep among them, rendering travelling on them impossible. Near to Portland they are as large as a hen's egg, but gradually diminish in size from thence, till at Abbotsbury, the opposite extremity, they are not larger than horse-beans. This diminution is so regular and invariable, that it is said the smugglers who land in the night can at once determine on what part of the bank they are by examining the pebbles. There can be no doubt, from the direction of the ridge, with the fact of the larger stones being at one end and the smaller at the other, that they are washed up from the bottom of the sea by the south-west storms, which are peculiarly prevalent and violent on this part of the coast, the waves carrying the lighter material the farthest. Sometimes, with north-east winds, the waves completely remove portions of the pebbly covering of the bank, and expose the substratum of blue clay in patches, but the denuded spaces are recovered when the south-west gales roll up heavy seas. With such terrific force does the ocean occasionally act, that during the storm of November 23, 1824, a vessel of ninety-five tons burden, laden with iron ordnance, was carried across the ridge, and safely lodged in the Swannery Fleet. Marine plants grow in patches by the water-side. Portland, an oblong mass of freestone resting on Kimmeridge clay, attached to the mainland by the long Chesil bank, the open sea on one side and a salt water creek on the other, has been oddly compared to "a breast of mutton hanging by a string."

The Lizard Point, a promontory of Cornwall, forming the south-east extremity of Mount's Bay, is remarkable for its geological structure and position. The headland is composed chiefly of serpentine, a rock

which is rarely developed in England. It rises to the height of nearly 200 feet, and is the most southerly part of Great Britain—generally the first land seen and the last observed by homeward and outward bound ships between the Atlantic and the Channel. In the adjoining Mount's Bay, a singular indication of change of weather has long been noticed by the fishermen, whose observations are confirmed by intelligent residents. There is often heard inland, at a distance from the shore, a peculiar hollow murmuring sound, locally termed "the calling of the sea," which, if proceeding in a direction different from the wind at the time, is almost always followed by a change of wind, generally within twelve, but sometimes not until a lapse of twenty-four or even thirty hours. It is heard occasionally at the distance of several miles, although on the shore from which it proceeds the sea may not be louder than usual; and yet, at other times, even when the sea is louder, and in apparently equally favourable states of the atmosphere, it cannot be heard at the distance of a mile. When the sound in fine weather proceeds from the coves or cliffs on the west or south of the observer, it is followed by a wind from about west or south, accompanied generally with rain. When it comes from the east or north of the observer, a land wind from about east or north succeeds, attended with fine weather in summer, and often with frost in winter. This "calling of the sea" probably arises from the well-known agitation along shore occasioned by a distant and approaching storm, and any peculiarities connected with it in the locality referred to may perhaps be occasioned by the position of the bay and the configuration of the coast.

The Land's End, at the western extremity of Corn-

wall, is also the most westerly land of Great Britain, the beginning and the end of the island, according as the line of its greatest breadth is followed eastward or westward. It is a ridge of granite projecting from an iron-bound coast of the same material, against which the ocean raves in front, on the right hand and on the left. The position of an observer at the point of the headland, closely approached by the stormy deep, and almost environed by it, is said to have suggested to Charles Wesley the solemn lines :—

“ Lo! on a narrow neck of land,
 'Twixt two unbounded seas I stand,
 Secure, insensible;
A point of time, a moment's space,
Removes me to that heavenly place,
 Or shuts me up in hell.”

The inhabitants of the district are not indifferent to its relation to the rest of the country. About a mile distant, the western side of a house has the inscription in large letters, “This is the first Inn in England;” while the eastern side is inscribed with “This is the last Inn in England.”

It has been supposed that the English Channel was once a gulf of the Atlantic, closed at its narrow and shallow western extremity by an isthmus, connecting Great Britain with the mainland of Europe, through which the sea cut its way in pre-historic times, and thus converted a peninsula of the continent into an island. The remarkable correspondence between the rocks and strata on the opposite coasts about Dover and Calais, with the fact of the same noxious animals, the bear and wolf, having existed on both sides of the strait since the date of authentic history, are the chief reasons assigned for the supposition. While it may never be established or disproved, it is certain, that the pre-

sent tendency of the action of the sea in that quarter is to widen the channel; and it is a somewhat singular circumstance, that long before the geology of the shores claimed attention, the idea of their former union was familiarly held. "That our isle of Albion," says old Verstegan, writing some two centuries ago, "hath been continent with Gallia hath been the opinion of divers." Sir Thomas More, a century earlier, alludes, in his "Utopia," to the same persuasion as not only current, but sustained by natural appearances. If ever an isthmus existed, its removal by the dash and gnawing of the waves was a most felicitous change. Had it remained "no history of England would have been written. The commentaries of Cæsar, our first authentic historian, would have dealt with that small peninsula as a portion of Gaul. The Roman, the Saxon, the Dane, the Norman, would not have struggled for the mastery of the island during ten centuries. For four centuries onward the great mixed nation which had grown upon the island would not have gone forth in their ships to crusade or conquest. What is more important, they would not have gradually modelled their own institutions at their own will, and have created a national character, which, at the end of four centuries more, enables them to look back upon a course of unceasing progress, whether of power in the state or of civilization in the people. If this sea-bridge had remained, no 'nook-shotten isle of Albion' would have planted America, or built up an empire in India, or colonized Australia. The language which is filling the earth would have had no distinct utterance. The history of England would have been the history of a province."

THE CENTRAL BASIN.

The Irish Sea, with St. George's and the North Channels, between Great Britain and Ireland, extends upwards of 200 miles from a line joining Carnsore Point in Wexford with St. David's Head in Wales on the south, to a line connecting Fair Head in Antrim with the Mull of 'Cautire in Scotland on the north. The greatest expansion is about 130 miles, a little to the south of the Isle of Man; but from Holyhead to Dublin the passage is only 60 miles. The two coast lines differ widely in their contour. Few openings or projections of any extent occur on the Irish shore. But besides the deep indentation of Cardigan Bay on the opposite side, the most extensive inlet of the sea exhibited in the British islands is formed between North Wales, Lancashire, Cumberland, and South Scotland, containing the estuaries of the Dee, Mersey, Ribble, Lune, and the Solway Firth. Wales has magnificent coast-scenery, especially in Caernarvonshire, where the Snowdonian mountains advance to the water's edge, and rise in Penmaen Maur almost perpendicularly from it to the height of 1,500 feet. The Irish coast is generally low, encumbered with shifting sands, bars, and sunk rocks, except in the north, where the mountains of Down and Antrim form the sea-board. Fair Head, a remarkable promontory of the latter country, which defines the northerly extent of the Irish Sea, is a lofty and vast mass of coarse columns of basalt, some being above 280 feet in length. At the base of these gigantic natural pillars lies a wild waste of rocky ruins, consisting of enormous blocks, which, in the course of ages have been precipitated from above by storms, or by the slow yet powerful operation of natural causes.



ROCKS NEAR DALLYBUNIAN BAY, COAST OF IRELAND.

The grand headland, at the foot of which the waves dash with tremendous fury, is characterized with a savage wildness. Scarcely a trace of vegetation intermingles with the hard rock to diversify its colouring and relieve its aspect.

The three basins which have been noticed are the close or narrow seas of Britain, branches of the outlying Atlantic Ocean, which rolls its billows into the Bristol Channel, sweeps round the greater part of Ireland, and along the west of Scotland to the Shetland isles. The force of its huge breakers is strikingly proclaimed by the shattered and invaded aspect of the land wherever fully exposed to their dash. While the coast is generally rocky and precipitous, it consists largely of long narrow peninsulas, as if caused by the denuding action of the waves upon the more yielding materials of a shore originally compact. These peninsular formations are specially characteristic of the south-western coasts of Ireland, which directly meet the shock of south-western storms, from which quarter storms in our latitude are most frequent and violent. But the ocean has not cut its way into the land and exerted destructive agencies without offering compensation for its ravages. An instance is supplied by the secure, landlocked, and magnificent havens which the peninsulas inclose, such as Bantry Bay and others, which rank with the finest harbours in the world.

It is not uncommon, along the whole coast-line of the Atlantic, for a great swell to rage during a perfect calm of the atmosphere. This marine disturbance is the effect of a distant tempest, which may a day or two afterwards reach the spot where the swell is observed. It is hence regarded as a prognostic of boisterous weather, and affords proof that the agitation caused by the

wind on the surface of the deep travels faster than the wind itself. Sometimes no change of weather at all is experienced, owing to the storm expending its energies out at sea. But when high gales reach the land, the oceanic displays are terribly sublime, especially among the islet groups on the western shores of Ireland and Scotland, which are exposed without a barrier to the attacks of heavy seas. Huge accumulations of water in long rolling billows dash upon the strand, foaming and roaring with terrible violence, and are perhaps more suggestive of irresistible power than any other sensible object. Nor is it easy for the stranger to divest himself of a feeling of insecurity as he views the mighty waves advancing against the site, however firmly based, upon which he may be standing. Sheets of spray are thrown far up into the air, and carried miles inland by the winds, rendering springs at some distance from the beach brackish for days, and incrusting everything with salt. Marine plants, insects, and shells are scattered far and wide over the face of the country, and fragments of rock, torn from their solid beds, are hurled as the artillery of the deep upon the shore. The Orkney men say that the floors of their cottages are shaken by the violence with which the waves strike the crags.

Detached masses of several tons weight lie scattered in chaotic confusion upon many a beach in the Shetlands, which the storms of every winter toss to and fro like marbles, grinding some down to pebbles while adding others by disruption from the cliffs. "The isle of Stenness," says Dr. Hibbert, "presents a scene of unequalled desolation. In stormy winters, huge blocks are overturned, or are removed from their native beds, and hurried up a steep acclivity to a distance almost incredible. In the winter of 1802, a tabular-shaped

mass, eight feet two inches by seven feet, and five feet one inch thick, was dislodged from its bed and removed to a distance of from eighty to ninety feet. I measured the vacant bed from which a block had been carried away the preceding winter, and found it to be seventeen feet and a half by seven feet, and the depth two feet eight inches. The removed mass had been borne to a distance of thirty feet, when it was shivered into thirteen or more lesser fragments, some of which were carried still further - from thirty to one hundred and twenty feet. A block, nine feet two inches by six feet and a half, and four feet thick, was hurried up the acclivity to a distance of one hundred and fifty feet." Speaking of the island of Roeness, he states, "A mass of rock, the average dimensions of which may perhaps be rated at twelve or thirteen feet square, and four and a half or five feet in thickness, was first moved from its bed, about fifty years ago, to a distance of thirty feet, and has since been twice turned over. But the most sublime scene is where a mural pile of porphyry, escaping the process of disintegration that is devastating the coast, appears to have been left as a sort of rampart against the inroads of the ocean. The Atlantic, when provoked by wintry gales, batters against it with all the force of real artillery, the waves having, in their repeated assaults, forced themselves an entrance. This breach, named the Grind of the Navir, is widened every winter by the overwhelming surge that, finding a passage through it, separates large stones from its sides and forces them to a distance of no less than one hundred and eighty feet. In two or three spots, the fragments which have been detached are brought together in immense heaps, that appear as an accumulation of cubical masses, the product of some quarry."

Marine caverns, haunted by seals and sea-birds, some of which were formerly used by smugglers as places of concealment for their goods, with isolated, tunnelled,



and split rocks, the latter sometimes united at the summit by rude natural bridges, are features of our more exposed and iron-bound coasts. They exhibit a strange

and often fearful magnificence—a wild beauty or savage grandeur—the effect of which is heightened by the boom of the billows in the hollowed precipices, or their splash against the exterior cliffs repeated by a thousand echoes, and mingling with the cry of vast flights of curlews, gulls, guillemots, razor-bills, cormorants, or herons. The caves of Ballybunian, at the south entrance of the Shannon, are remarkable for their number and configuration. At the South Stack, a detached rock off the isle of Anglesea; along the bold shores of Cornwall and North Devon; on the coast of Yorkshire; and at various points of Scotland, there are very striking examples. Near St. Vigean, in Forfarshire, a hollow appears in the centre of a field bordering on the cliffs, called the Gaylet Pot, which deepens on being approached. On reaching the edge, the eye looks down a precipice about a hundred and fifty feet in depth, and sees the waves dashing along the bottom. Descending by a somewhat precarious path, it is found to be a long tunnel-like cavern communicating with the sea. Through the deep gloom of the passage, the sunlight may be seen playing beyond, and now and then a white sail passes the opening, as if flitting across the field of a telescope. The Gaylet Pot seems to have been originally merely a deep, straight cave hollowed by the waves, and it owes its present appearance unquestionably to the falling in of the roof at its inner extremity. The Bullars of Buchan are named from the peculiar bellowing noise of the waves in storms, rushing through the arched rocks and into the caves which mark the granite coast of Aberdeenshire. M'Swine's Gun is a perforated rock on the western side of Horn Head in Donegal. When the wind sets in from the north-west, the sea is driven with such violence into it as to rise through an opening

in the rock above in lofty jets, with a report which may be heard for some miles.

Those risings and subsidings of the engirdling waters by which a portion of the shores is alternately flooded and left dry, and to which we give the name of tides, are propagated in our narrow seas from the great diurnal undulations of the Atlantic, which receives them from the South Pacific Ocean, as the effect of astronomical causes, the lunar and solar attraction. They are to the inhabitants of the coasts the most interesting, to seafaring people the most useful, and to the ignorant the most inexplicable of all the every-day occurrences of life.

The general progress of a tide-wave to and along our shores may be sketched, the reader bearing in mind that in rather more than twelve hours after it has started on its course, another has set out on the same route. A high-water ridge raised in the deep, unobstructed, and capacious basin of the Southern Ocean, propagates itself with immense velocity by undulation, and is off the Cape of Good Hope about thirteen hours after it has struck the shores of Australia, which may be called the thirteenth hour of its life. Arrived at the mouth of the Atlantic, it follows the direction of its bed, north by west, successively bringing high water to the different ports on its eastern and western coasts. But it travels with much greater velocity through the central parts than along the shores, owing to their obstructions, so that the co-tidal lines become extremely elliptical. Thus, in eleven hours from the Cape, the twenty-fourth hour of its life, the central area of the undulation will have reached Newfoundland, while its skirts are at the Bahamas on the one side and at Cape Blanco in Africa on the other. Turning north-east, the

direction of the ocean, in four hours afterwards, the twenty-eighth hour of its career, the tide-wave has advanced to the British Isles, the ridge extending from off Brest Harbour in France across the mouth of the English Channel to the south of Cape Clear in Ireland. Here, interrupted in its progress by the islands, three branches are formed. One branch passes up the Channel and through the Strait of Dover into the North Sea. A second enters the Bristol Channel and through St. George's into the Irish Sea. The third and principal branch proceeds along the western shores of Ireland and Scotland, travelling with greater velocity than the other two, being in an open sea. After rounding the Orkneys and Shetlands, it pursues a perfectly inverted course, descends into the North Sea, and in eight hours, the thirty-sixth hour of its existence, the high-water ridge extends from Buchan Ness, on the coast of Aberdeen, to the Naze of Norway. Twelve hours afterwards, the forty-eighth hour of its course, the ridge is off the mouth of the Thames. It is this great northern wave that determines high-water along the east side of Great Britain and at London by its superior intensity. The one from the Channel carries it to the shores of Germany, and has very slight influence upon the opposite coasts of England, owing to their obliquity to its direction.

Thus high-water at London-bridge, at any given time, is the dying undulation of a flood, which, upwards of two days before, struck upon the nearly antipodal beach of Australia, the intermediate time having been occupied in propagating itself by oscillation to the Thames.

While in the open ocean, the tidal rise is but slight; in our narrow seas and contracted channels it is very marked. On Boston Deep, in the Wash, spring-tides rise 23 feet; at Chatham, 18; London-bridge, 18; Spurn

Head, 23 ; Hull, 22 ; Newhaven, 20 ; Exmouth, 18 ; Milford Haven, 28 ; King's Road, at the mouth of the Bristol Avon, 48 ; and at Chepstow, on the Wye, it is sometimes 60 feet. Where the shores are low and flat, immense tracts are alternately flooded and left dry. Some broad estuary bays may be crossed almost entirely on foot, where on the same day sloops and barges sail. On the coasts of Lincolnshire and Lancashire, extensive spaces have been recovered permanently from the water-floods by embankments, and converted into cultivable soil. All land between high and low-water mark around our islands is the property of the crown, except in cases where a grant has been made of it to an adjoining proprietor, of which there are many examples. The instinct of some animals with reference to tidal phenomena is very extraordinary. Writing of the western isles of Scotland, Dr. Macculloch remarks, that "the accuracy with which the cattle calculate the times of ebb and flood and follow the diurnal variations is such, that they are seldom mistaken, even when they have many miles to walk to the beach. In the same way they always secure their retreat from these insulated spots in such a manner that they are never surprised and drowned."

The change produced in the aspect of our rivers by the advance of the tide is of the most striking description, and confers important benefits upon the towns seated along their banks, rendering them essentially maritime, though not situated upon the coast. The Avon at Bristol supplies a remarkable example of this alteration and of the commercial advantages resulting from it. Its character at low-water is that of a shallow brawling stream, scarcely navigable by the smallest craft, but at high-water the largest steamers and West Indiamen come up to the city. The change brings not

only a supply of water adequate for navigation, but an alternate current every twelve hours, which is just as useful as having a fair wind up and down the river in that time, the regular occurrence of which is certain, and can immediately be turned to account by previous preparation. Spring tides signalize their presence in some of our rivers, as the Trent and Severn, in a surprising and formidable manner to the stranger. Often while the stream is calmly flowing and the surface scarcely shows a ripple, a low, sullen roar gradually breaks upon the ear, becoming louder and advancing nearer every moment, till a hill of water, with a white ridge of foam, comes rolling up at a rapid rate, instantly altering the level, and tossing the barges and boats about in all directions. This sudden irruption, called a "bore," locally the "heygre," appears to be caused by the oblique relation of the river channel to its estuary, which opposes the free influx of the tide-wave. An accumulation of tidal water is thus produced by the arrest at the mouth, which at last acquires sufficient power to disengage itself, and furiously rushes in an immense volume up the stream.

On the west and north of Scotland, the multitude of the islets, and the narrow channels between them, obstruct the tide-wave, produce endless divergencies from its natural direction, and put in motion powerful currents flowing from different points which occasionally meet, giving rise to whirlpools and strongly agitated waters. The Roust of Sumburgh is an example, denominated from Sumburgh Head, the south promontory of the Shetland. The word *roust* is of Scandinavian origin, and denotes the strong and tumultuous sea-current in the neighbourhood. The "Merry Men of Mey" designates a spot off the coast of Caithness,

where the sea has a perpetually disturbed surface—the word *men* being a corruption of *main*. Through the Pentland Firth, between the Orkneys and the mainland, the tide rushes with the speed of a race-horse, and there are side currents counter in their course to that of the central stream. On the west of Scotland, in the narrow strait between the islands of Jura and Scarba, the remarkable whirlpool of Corryvrechan is formed by the collision of strong tidal currents. The name is derived from that of a Danish prince who perished at the spot. When the flood-tide has entered the strait, which is about a mile wide, the sea appears in great commotion at the place of the whirlpool. It boils, and foams, and rolls away in successive whirls. At the fourth hour of the flood the disturbance reaches its maximum, and throws up with strong ebullition everything from the bottom. The roar of the waves is heard for many miles, and at that time it is generally fatal to approach the gulf. But from the middle of the fifth hour to the sixth of the flood, in spring tides, with some difference in neap tides, the commotion gradually subsides, and the smallest boat may pass with safety. After the return of the ebb, however, the same phenomena are repeated, increasing and diminishing at corresponding times, till at the approach of the lowest ebb there is again a calm. The intermittent characters of the whirlpool may be explained by the flood-tide alternately conquering the opposite current, and being defeated by it at the ebb, the agitation being maintained while the relative strength of the two currents is somewhat evenly balanced. To listen, to the roar of the distant Corryvrechan, the poet Campbell, who resided for some time in the adjoining island of Mull, often visited the Point of Calliach, from which it may be

heard. This is said to have been the birth-place of the "Exile of Erin" and of much of the "Pleasures of Hope."

In all its moods, the expanse of sea and ocean is a glorious object of contemplation—not more calculated to gratify the eye than suggest useful and impressive thought to the reflecting mind. Apparently boundless and unfathomable, it seems set forth before us as a visible image, designed to aid our limited understandings, to conceive somewhat of the immensity with which we are connected, and of the eternity to which we hasten; while ever-changing in its aspect, alternately smooth and rough, calm and vexed, shining and sombre, it symbolizes the mutations of human fortunes and the vicissitudes and uncertainties of life. Though perpetually oscillating, while its movements appear most ungoverned and erratic, yet dutiful subjection to law is signified by the restraint of its waves within general limits. If the tides flowed on for a few hours all things living would be destroyed by a second deluge; out, everywhere under an invisible control, at an appointed time they become reflux. Hurling the weight of their billows upon the shores, the seas grind them down and wear away the coast, but pile up, by way of compensation, new land in other quarters by the deposition of the spoil. A storehouse of life for the service of man, "wherein are living things innumerable, both small and great beasts," the ocean acts also as a reservoir from which his fields are supplied with rain. With peculiar emphasis, in allusion to its wonderful economy, the great deep is spoken of by an unerring voice as the immediate work of the Almighty, subject constantly to his regulation, and conveying a lively idea of his power and wisdom. "The sea is his,

and he made it :”—He brake up for it a “decreed place, and set bars and doors, and said, Hitherto shalt thou come, but no further : and here shall thy proud waves be stayed :”—“He hath compassed the waters with bounds, until the day and night come to an end.”

Though purposes essentially necessary and useful at present are accomplished by the arrangement that “founded the earth upon the seas, and established it upon the floods,” those who “do business in the great waters” have frequently to encounter change of scene upon the unstable element, and meet with peril, often finding an uncoffined grave in its bosom, when the windy tempest blows. A storm at sea, with the consequent danger to the mariner, and his best resource, are finely pictured by the Psalmist :—“He commandeth, and raiseth the stormy wind, which lifteth up the waves thereof. They mount up to the heaven, they go down again to the depths : their soul is melted because of trouble. They reel to and fro, and stagger like a drunken man, and are at their wit’s end. Then they cry unto the Lord in their trouble, and he bringeth them out of their distresses. He maketh the storm a calm, so that the waves thereof are still. Then are they glad because they be quiet : so he bringeth them unto their desired haven.” Thus ordinarily is the wild commotion mercifully regulated by an overruling Providence ; for safe voyaging at sea is the rule, and maritime disaster the exception. This fact ought to be distinctly and thankfully noted. Still shipwreck from the war of elements, and other casualties of the deep in hours of calm, are modes by which men are removed from time into eternity, and are admonitory dispensations of the Almighty, which the living meet upon the wave as on the shore, to remind them of the uncer-

tainties of their condition, of an inevitable lot, and of their constant dependence upon God.

Crews embark in high spirits, with a dancing deep, a bright sky, a favourable breeze, and every prospect of a safe and happy transit to port. But the scene changes with the emotions of the passengers, when the heavens gather blackness, and the breeze becomes a storm-wind, while the rain pelts pitilessly, and the drenching spray comes on board like a deluge. Billows toss the vessel to and fro like a cork, and threaten every moment to engulf it; or the craft is driven on an iron-bound coast to be totally broken up, when the hardest

" Buffet long the wave,
And grasp at life, though sinking in the grave."

A map is not ordinarily a mournful document, but the Wreck Chart of the British Isles, annually published by the Harbour department of the Admiralty, is of this description. The whole line of the sea-coast bristles with a series of round black marks, not uniform in number, but varying from one to twenty at different points. Each mark indicates a shipwreck, and its too frequent corollary, loss of life. The greatest number, of course, occurs where there is the largest amount of shipping and the shores have peculiar dangers, as the Goodwin Sands, the neighbourhood of the colliery ports, and the Bay of Liverpool. It is grievous to find, that, upon an average, not less than one thousand lives are annually lost by wreck and other casualties within the limits of our narrow seas. This fact ought to lead to a national legislative effort to provide the shores competently with the means of preserving life instead of leaving it to voluntary munificence, while it becomes the solemn duty of Christians to lose no

opportunity of declaring the message of God's love to man to seafaring people, who are so peculiarly in jeopardy of a watery grave.

In this respect, as far as outward circumstances are concerned, "all things come alike to all," whether their character be depraved or holy,—whether keeping the commandments of the Lord, or in rebellion against him. If the Jewish prophet, flying from an obvious obligation, was in jeopardy of his life on the voyage to Tarshish, so was the Christian apostle, while in the path of duty, on his passage to Rome; and thus peril encompassed the disciples of Christ, when he was with them on the sea of Galilee, and they expressed their helplessness and fears in the prayer, "Lord, save us: we perish." Equally significant proofs are afforded by the general history of life, that men are not the masters of their own destiny, but are really under the control of the invisible and mighty hand of God, who clouds their prospects and frustrates their plans according to his pleasure. "The lot is cast into the lap; but the whole disposing thereof is of the Lord."* "The horse is prepared against the day of battle: but safety is of the Lord."†

Never did Jesus of Nazareth appear more conspicuously clothed with Divine majesty and dominion than when he said to the boisterous waves and howling winds, "Peace, be still!" and "the wind ceased, and there was a great calm."‡ All power over outward circumstances and external causes of distress being in his hands, he was pleased to exert it for the welfare of his disciples; and it is a most blessed fact, that he ever lives, just as able and willing to quell spiritual troubles as to quiet the disturbed elements of nature,—to save the soul from death

* Proverbs xvi. 33.

† Proverbs xxi. 31

‡ Mark iv. 39.

as to deliver the body from destruction. He reconciles to God, through the blood of his cross, those who believe on his name, and frees them from the misery of a guilt-burdened conscience ; he renews them in the spirit of their minds by the unction of the Holy One and the word of truth ; and he will one day remove them for ever from all that has a tendency to agitate the mind and pain the heart. “ And I saw a new heaven and a new earth : for the first heaven and the first earth were passed away ; and there was *no more sea*.”* The statement intimates, as one part of its signification, that the ultimate condition of all believers will be free from those dangers, inconveniences, and fears which are incident to their present life, and of which the great waters are at once a common cause and an appropriate emblem. Reader, remember that you are now on the sea of life, bound for the ocean of a great eternity, and that you can never reach the desired haven without trusting in the power and mercy of Christ to guard you from the dangers of the voyage, and conduct you in safety through its storms.

* Revelation **xxi.** 1.

CHAPTER IV.

THE GREAT GEOLOGICAL FORMATIONS.

Mineral Diversities—Productive Soils—Assemblages of Rocks—Forms of Stratification—British Stratified Rocks—Tertiary System—Basin of London—Cretaceous System—Aspect of Chalk Districts—Wealden System—Sussex Marble—Oolite System—Aspect of the Country—The Liass—New Red Sandstone—Rock Salt—Magnesian Limestone—Carboniferous System—Coal—The Coal Fields of England—Position of Coal Seams—Millstone Grit—Mountain Limestone—Old Red Sandstone—Silurian System—Clay Slate—Mica-Schist and Gneiss—Unstratified Rocks—Granite—Its Varieties and Uses—Trap Rocks—Columnar Basalt—Giant's Causeway—Pleaskin—Useful Adaptations—Aqueous and Igneous Agency.

THERE are countries which may be traversed through immense distances, yet the surface not only continues a general level, but the very constitution of the soil itself is the same throughout. This uniform flatness excludes the sublime and beautiful from the natural landscape; while the sameness of the soil may be a good or an evil according to its physical properties. Thus, in Russia, the traveller may journey a thousand miles, or more, without meeting with a crag or dell. He passes over slightly undulating ground, which does not shift his level more than a hundred feet, while Moscow, the old capital of the empire, is seated upon a stratum of black earth, the area of which is three times greater than that of the whole of France. But in the course of a very brief journey from our metropolis, whatever may be the direction taken, the observant passenger will perceive striking varieties in the form and properties of the land, while the country at large exhibits specimens of most of the rocks which compose the entire

crust of the globe. Within comparatively narrow limits, all those great mineral masses are met with which are best adapted to supply the wants and stimulate the energies of mankind. There is perhaps no portion of the earth's surface, of the same extent, where the geological varieties are so numerous as in Great Britain; for, though the products of modern volcanoes are happily wanting here, igneous rocks occur belonging to the granite and trap formations. It seems as though the island had been placed in a corner of Europe to serve the purpose of an index map to the continental formations.

Diversity in the mineral structure of a country is of great advantage; for hereby the superficial soil, which is usually derived from the disintegration of the rocks beneath or adjacent, receives that due admixture of different ingredients upon which fertility depends. Productive fields are not formed of pure clay, sand, or chalk; but those lands are the most fertile, and the least liable to exhaustion, which contain these three earths in combination, with a portion of decomposed animal and vegetable matter. Aluminous or clayey soils retain too much moisture, while siliceous or sandy, and cretaceous or chalky soils part with it too rapidly: the former are too adhesive and the latter too loose for the purposes of cultivation. The clay lands are hence greatly improved by the use of chalk, which lessens their adhesiveness and renders them drier, while clay is an equally efficacious manure on chalky or sandy soils, correcting their looseness, and promoting their moisture. The operations of nature in the percolation of rains, the flow of rills, streams, and floods, have largely clothed with a productive surface the hard and stony skeleton of the country, by mixing the materials of different rocks;

and, in districts where one of the earths prevails in the soil to the exclusion of the others, the scientific agriculturist, by copying nature, remedies the defect, and converts the comparatively barren waste into a fruitful field.

The ground we trample under foot seems to the dull eye of rustic ignorance a chaotic heap of equally confused materials. But it is really very definitely arranged, consisting of distinct systems of rocks, which, as regards the stratified masses, invariably preserve the same relation to each other, being either lower or upper, sub-jacent or superimposed, though by a wise and beneficent providential dispensation, by various dislocating forces, they so deviate from the horizontal direction as to be brought in succession to full exposure at the surface. All the great assemblages of strata may have component substances in common—aggregations of lime, clay, and sand—forming hard calcareous, argillaceous, and arenaceous masses; but there are peculiarities of structure by which, upon a great scale, they are distinguishable from each other, while a broad line of distinction is drawn between them by the nature of their organic remains. William Smith, “born upon the oolite,” at Churchill, in Oxfordshire, in 1769, a man of humble origin and scanty education, but of sagacious mind and unwearied industry, was the first to seize and illustrate the great facts of the orderly succession of strata, and the constant distribution of similar organic remains in similar formations. While earning his bread by the sweat of his brow, as a surveyor and engineer, unaided by public support and long uncheered by even any general sympathy in his labours, he carefully studied those productions of the Almighty which men had trod upon for ages. After a life of threescore years and ten,

he died upon the oolite—the scene of his most exact observations—in 1839, while upon a visit to a friend at Northampton. As the discoverer of the master-principles of geological science, and the first to construct a stratographical map of his native country, he is justly styled the “Father of English Geology.”

Every kind of formation is included in the two great divisions of the “*stratified*” and the “*unstratified*.” Most of the former are crowded with organic remains, while all the latter are non-fossiliferous. The stratified masses, which constitute by far the greater portion of the exposed solid matter of the globe, and vastly predominate in the United Kingdom, exhibit a regular divisional structure into layers or beds, to which the Latin word *strata* is applied, and have apparently been formed by successive processes of deposition at the bottom of seas or lakes. These beds vary in thickness from that of paper to that of many yards; and also in position and form, being horizontally disposed, or inclined at all angles, and sometimes vertical, curved, arched, and variously contorted. The operation of a disturbing and elevating force, subsequent to deposition, is intimated by these inclinations and derangements. In the rock of calcareous red grit on which Powys castle stands, near Welshpool, Montgomeryshire, North Wales, the strata are vertical, and appear like massive buttresses erected for the purpose of supporting the noble structure placed upon them. A remarkable curved mass of gneiss appears at Oreby, in the island of Lewis, and seems at a distance like an unfinished artificial monument, half the archway of a bridge. On the banks of the Wye there is an equally striking example of completely arched and contorted stratification. In the other division, that of the unstratified

rocks, which includes trap, granite, porphyry, and serpentine, no regular structure resembling a series of beds is observable; but they occur in uniform crystalline masses, only broken by irregular fissures in different directions.

BRITISH STRATIFIED ROCKS.

The systems of strata developed in the British isles are as follows: the Tertiary; the Cretaceous; the Wealden; the Oolite; the Lias; the New Red Sandstone; the Carboniferous; the Old Red Sandstone; the Silurian; the Clay-slate; the Mica-schist; and the Gneiss. They are named from the most characteristic rock in each, or from locality.

TERTIARY SYSTEM.—This scheme of formations consists of sands, clays, and limestones, occupying great hollows of the chalk, and occasionally of other strata, the materials being in general loosely aggregated. They compose the basin of London, which includes the whole of Middlesex, the north of Surrey, the north of Kent, except the eastern extremity, with the Isle of Sheppey, and are continuous through the eastern counties of Essex and Suffolk, with the greater part of Norfolk. They are also exhibited in Hampshire, in parts of the adjoining counties to the east and west, Sussex and Dorset, and in the north of the Isle of Wight. Similar deposits appear faintly in Scotland, in the valley of the Clyde, but have not been recognised in Ireland. The arenaceous members of the tertiary system, though seldom indurated, occasionally form a hard white sandstone, of which Windsor Castle is built. As mere beds of sand, they vary widely in colour, being in some dis-

tricts white, as on the heaths of Dorset ; in others of a general green tinge derived from the silicate of iron ; while at Alum Bay in the Isle of Wight they are magically tinted with varying lines imparted by the oxide of iron. The argillaceous members likewise exhibit considerable variety of colour, and occur also as nearly pure clays, or with sandy admixtures, and as marls more or less calcareous. The limestones of this group are coarse, heterogeneous formations, locally known as "crag" in the eastern counties, and remarkable for organic remains. More than half the surface of Europe consists of tertiary deposits, upon which some of its greatest cities are seated, as London, Paris, Vienna, and Turin.

The basin of London may be described in detail, owing to the interest of the site. It occupies a depression of the chalk, which appears surrounding it on the north, west, south, and south-east in the chalk hills of Hertfordshire, Buckinghamshire, Berkshire, Surrey, and Kent. That the chalk actually underlies the basin is proved by the sinking of wells to it through the superincumbent tertiary beds. Borings to the chalk for water go, at the Model Prison, Pentonville, to the depth of 370 feet ; at the Bank of England, 334 feet ; at Webb's soda water manufactory, 350 feet ; at Combe and Delafield's brewery, 500 feet ; at the fountains, Trafalgar-square, 510 feet ; and at the Crystal Palace, Sydenham, 800 feet. Immediately over the chalk, there is a formation of plastic clay, so called from the use made of that material for pottery ; but this is merely a thin subordinate stratum, connected with extensive depositions of sand and shingle. The Tunnel under the Thames from Rotherhithe to Wapping traverses this formation, and the main difficulties of its construction arose from the

loose sandy strata passed through. The next member is the well-known firm London clay, which forms the general substratum of the metropolis and its vicinity, occurring immediately below the superficial accumulations. It is of varying thickness, chiefly of a dull grey, blue, and ochreous colour, so tenacious that water cannot pass through it naturally, but is obtained abundantly by Artesian wells perforating its entire mass. Marine shells are numerous in it, and the skeletons of crocodiles and turtles have been found at Islington and Highgate. Pieces and even masses of fossil wood have also been often met with, exhibiting the perforations and casts of a worm allied to the *teredo navalis*, the ship-worm, or borer, which now infests the seas, and proves so destructive to vessels. The third and uppermost member of the London basin consists of arenaceous deposits, the sands of Highgate, Hampstead, Finchley, and Bagshot Heaths, forming the wastes abandoned to their native furze, which mark the neighbourhood of the capital.

The Isle of Sheppey, at the mouth of the Thames, is an outlier of the London clay, being composed of it, and one of the most interesting of geological sites, on account of the abundance and nature of its fossils. Besides the usual shells, there are here to be found the remains of vertebrated fishes and crustaceans; of birds, serpents, and turtles; of plants allied to the cucumber, bean, cypress, and laburnum; of the fruits of palms, and specimens resembling the spices of the east. So numerous are the vegetable relics, that they are estimated to indicate many hundreds of species, mostly of a tropical nature.

CRETACEOUS SYSTEM.—This group, one of the best

known and clearly defined formations of the globe, is entitled after the name of the prominent mineral, chalk (*creta*). It extends over a considerable part of the southern, south-eastern, and eastern counties of England, overlooks the waters of the North Sea at Flamborough Head in Yorkshire, and those of the channel at Dover, Brighton, and Sidmouth, though it is not continuous through the interval between the northern and southern points. From the former promontory, Flamborough Head, it travels inland in a large curve to the Humber, reappears on the Lincolnshire side of the river, and proceeds in a broad band to Spilsby in Lincolnshire, where its course is interrupted. South of the estuary of the Wash, it occurs in a detached curved tract in Norfolk. At Thetford, in that county, it becomes continuous, from thence ranging southward through the counties of Cambridge, Bedford, Hertford, Buckingham, Berks, Oxford, and Wilts, to the sea in Dorset and east Devon. Proceeding eastward from Wilts, it extends through Hampshire, Sussex, Surrey, and Kent, to the coast at the South Foreland. Thanet and the south part of the Isle of Wight are detached chalk districts. Cretaceous rocks are entirely wanting in Wales and Scotland; but they occur in the north of Ireland, in contact with the basalt of the Giant's Causeway, where the chalk, as if acted upon by intense heat, has undergone metamorphic change, and been converted into a crystalline marble.

The *chalk* part of the group consists of two divisions, upper and lower, which vary in character as well as in position. The upper chalk is friable, often of a clear snow-white colour, and is traversed by numerous flints, arranged in horizontal layers: the lower chalk is hard, sometimes sufficiently so to be used for a building stone,

and has a dusky or even a reddish hue, with few flints, or none at all. In the lofty Speeton cliffs, near Flamborough, both are exposed, the lower chalk exhibiting a brick-red or chocolate colour, with other tinges, which strikingly contrast with the milk-white aspect of the upper, which is brilliant when lighted up by the sunbeams. Chalk with numerous flints, or with few, and without them, may be seen in the range of rocks stretching from Shakspeare's cliff, near Dover, to the South Foreland, and round that point to St. Margaret's Bay. The flints are siliceous aggregations frequently around organic substances, such as parts of shells, sponges, and other marine matters. Chalk marl, highly calcareous, and of a bluish hue, provincially called "*gault*," and arenaceous beds, the upper and lower green sands, are other components of the cretaceous system. The sand, though commonly loose, is sometimes formed into sandstone by a calcareous cement, and appears at the elevation of nearly a thousand feet, at Leith Hill, in Surrey. Only in one instance with us does the chalk rise higher, namely, at Inkpen Beacon, near the junction of the counties of Wilts, Hants, and Berks.

Though treeless hills—the "wolds" of the north and the "downs" of the south—with streamless valleys, are characteristic of chalk districts, yet their physiognomy is not unprepossessing in general, and is often attractive. There are no lofty rugged peaks as in schistose regions; no tabular-looking or altar-like escarpments, as in the oolite and lias; no deep narrow dales, with steep rock acclivities, as in the mountain limestones. Still, the hills are noble, intersected with valleys in every direction; and both are remarkable for a smooth, flowing outline, forming scenes of great

amenity and rural beauty. The economic value of the deposits is considerable. Chalk is used for many purposes in the arts, furnishing polishing paste and the well-known whitening of the painter. The flints supply material for the manufacture of glass and porcelain; and beds of fuller's earth occur in the lower green sand. Though, from the dryness of chalk lands, they are only adapted for sheep-walks in their natural state, producing a short, sweet herbage, yet, when well manured, they repay the enterprise of the agriculturist with luxuriant cereal crops. The beech thrives in the soil, and becomes a noble tree in the grassy, bay-like openings which mark the ranges of the hills. When a member of parliament vacates his seat by accepting the stewardship of the Chiltern Hundreds, he takes in hand a task no longer required—that of watching over a chalk domain in Oxfordshire, once famous for the harbour afforded to bandits by its beech woods.

WEALDEN SYSTEM.—The strata under this name occupy the wealds or wolds of Kent and Sussex, a district covered with extensive forests in former times, and hence so denominated from the Saxon *wald*, a wood. Caxton, the first English printer, in the first book ever printed in the native language, says: "I was born and learned mine English in Kent, in the weald," a tract of country now under high cultivation, but then described as a "wilderness, stored and stuffed with herds of deer and droves of hogs." The locality in question ranges from the sea for some miles on each side of Hastings to Tunbridge on the north, and westward to Horsham and Petworth, between the two ranges of chalk which form the hills of the North and South Downs. Its geology is remarkable for presenting no remains of marine life,

which are alone found in the contiguous cretaceous strata; but there is an abundance of freshwater shells, various land plants, and relics of some of the largest and most remarkable terrestrial animals. Dark ferruginous sands and sandstones, with an inclosing zone of blue or brown tenacious clay, appear at the surface. Outlying portions of the same beds surmount the northern brow of the peninsula of Portland, form that of Purbeck, and occur in the Isle of Wight.

The *clay* of the weald contains thin beds of limestone, which has long been quarried at Petworth and other places, and is of historic as well as natural interest. It is almost entirely composed of *paludinæ*, the shells of a species of snail, held together by crystallized carbonate of lime. This limestone, when polished, forms the well-known *Sussex marble*, extensively employed by the architects of the middle ages for ornamental purposes. Columns, pavements, and monuments in our cathedrals and old churches are often composed of it, or of the Purbeck marble, a limestone of the same system and character, but an aggregation of much smaller shells. A row of columns in Chichester Cathedral, and those of the Temple Church, in London, the tomb of Queen Eleanor in Westminster Abbey, and the archiepiscopal throne in Canterbury Cathedral, are of this material—the fragile shells of humble snails, once familiar with slime and mud, which have been agglutinated into an enduring limestone by the chemistry of nature. But its employment in the arts goes back to a remoter date, namely, to the early part of the Roman age in Britain. In 1723, a slab of grey *Sussex marble* was dug up at Chichester, bearing an inscription recording the dedication of a temple, as follows: “The college, or company, of artificers, and they who preside over sa-

cred rites, or hold offices there, by the authority of King Cogidubnus, the legate of Tiberius Claudius Augustus, in Britain, dedicated this temple to Neptune and Minerva for the welfare of the imperial family; Pudens, the son of Pudentius, having given the site." This relic is preserved at Goodwood, the seat of the Duke of Richmond. But a more extraordinary and interesting monument of ancient days belonging to the wealden deposits is a bed of black mould, disclosed at Portland and in the cliffs of Lulworth Cove, on the adjoining main coast of Dorset, containing numerous *fossil stumps of trees*, the remnants of a forest. The stumps stand erect at the height of from one to three feet, and are at distances from each other corresponding to trees in a forest. The summits are jagged, as if the trunks had been snapped by a hurricane; and as the roots are attached to them, they occupy now the spot on which they lived and flourished.

OOLITE SYSTEM.—This series of rocks, chiefly limestones and clays, stretches in a wavy course from the coast of Dorset, through the counties of Somerset, Gloucester, Oxford, Northampton, Lincoln, and York, where it terminates at the sea near Scarborough, thus traversing almost the whole extent of England from south to north. It is very slightly developed in Wales, Scotland, and Ireland. The name refers to a peculiarity of structure, not universal, but sufficiently prevalent to be characteristic. The hard masses have small globules imbedded in them resembling minute eggs, or the roe of a fish; and hence the term oolite, from *ὄον*, an egg, and *λίθος*, a stone. These are, for the most part, in fact, small shells. Portland stone, Kimmeridge clay, Coral rag, Oxford clay, Cornbrash, Forest-marble, great oolite or Bath stone, Stonesfield slate, Fuller's earth,

and the inferior oolite, are prominent components of the group. It must not be imagined that the formations thus denominated are as local as some of the names denote, but that they are very characteristic at the sites referred to. Thus, the great oolite, or Bath stone, is prominent about Northampton and Stamford, where it is quarried, and extends into Yorkshire. The Oxford clay is met with near Sleaford and Brigg to the south and north of Lincoln. Portland stone appears in the vale of Aylesbury; and Kimmeridge clay fills the vale of Pickering, watered by the Yorkshire Derwent.

Portland stone, a calcareous and siliceous freestone, occurs in beds of no great thickness at the spot from which it is named, where it has long been quarried for architectural purposes. St. Paul's, Somerset-house, Goldsmiths'-hall, the Reform Club-house, and many of the public edifices of the metropolis, are built of it. Some portions of the *Kimmeridge clay* form a highly bituminous shale. This is the case near the village so called on the coast of Dorset, where it is burned for fuel; but elsewhere it is simply a tenacious clay, with septaria and sandy concretions, called the oak-tree clay in Wiltshire, from its being covered with oak woods. The *Coral rag* is a limestone composed chiefly of corals, accompanied with beds of calcareous freestone, consisting largely of the comminuted fragments of shells. This stone is the material of many of the noble buildings of Oxford, whose appearance attests its easy destructibility, it being liable to scale off in large flakes after a few years' exposure to the weather. *Oxford clay*, generally of a dark blue colour, ranges along the valley of the Isis in Oxfordshire, the Ouse in Huntingdonshire, and the Witham in Lincolnshire. In the latter district, where it is known as the fen-clay, it has great expansion and thickness, having been bored to the depth of nearly

500 feet at Boston, in sinking for water. *Corubrash* is a Wiltshire provincialism for a coarse loose limestone, the exposed surface of which readily dis-integrates, and is *brashy* or breaky enough to be prepared by the plough for the growth of corn. The *Forest marble*, a fissile arenaceous limestone, is often a congeries of dark-coloured shells, capable of being polished, and hence worked as a marble in Whichwood Forest, Oxfordshire. The *Great oolite*, or *Bath stone*, the most important member of the series for thickness and utility furnishes an excellent freestone, and appears conspicuously in the beautiful hills near Bath. *Stonesfield slate*, used for roofing, forms the hilly sides of a valley, near a village of the name in Oxfordshire, and is of singular interest on account of its fossils, comprising land-plants insects, reptiles, and marsupial mammalia. *Fuller's earth*, a soft aluminous marl, remarkable for its property of absorbing oily matter, accompanies Bath stone in thick layers, in the neighbourhood of that city. The *Inferior oolite*, so named from its position and less economic value, consists of a dark coarse limestone, with ferruginous sand and sandstone, of which Dundry Hill, near Bristol, is a detached specimen, resting on a bed of lias.

Our oolitic tracts, though sometimes tame, have generally a gently diversified surface. But on their western side they rise to considerable elevations, and present bold escarpments, which overlook abrupt valleys, as in the vicinity of Bath and Stroud, or command extensive prospects over the undulating plains of lias and red marl, as in the Cotswold Hills in Gloucestershire. The valleys, unlike those of the chalk, have their streams or rivulets lined with rich grass lands and studded with noble timber. In many parts saintfoin luxuriates, and throws great beauty over the landscape by its dazzling summer blossoms.

LIAS SYSTEM.—This grand repository of those extraordinary marine reptiles, the fish lizards, ichthyosaurus and plesiosaurus, whose remarkable forms attract the attention of the most incurious in our national museum, is a series of clays, shales, and limestones. Like the oolite, which it accompanies with considerable regularity on its western edge, it forms a belt extending across the island from south-west to north-east, or from Lyme-Regis, in Dorset, to the coast near Redcar, in Yorkshire. It ramifies considerably to the west in Gloucestershire, entering the counties of Monmouth and Glamorgan; and there are several out-lying portions. The *lias* is supposed to owe its name to a corruption of the word *layers* by workmen, alluding to the unequivocal stratification displayed. Some of the shales, impregnated with bitumen and iron pyrites, are susceptible of slow combustion, which has taken place spontaneously when in contact with a sufficient supply of moisture. The phenomenon has occurred at the two extremities of the formation, near Lyme and Weymouth in the south, after heavy rains, and near Whitby in the north, upon the fall of a cliff letting in the sea. The combustion of some of these shales containing alumina yields the alum of commerce, which is extensively prepared by that process at Whitby. Lias limestones of the finer kinds are employed in lithography; and a variety, when burned, produces a lime which has the property of setting under water, for which reason it was used in the foundation work of the Eddystone lighthouse.

NEW RED SANDSTONE SYSTEM.—In point of commercial value, this group, consisting of marls, sandstones, and limestones, is perhaps second only to the carboniferous formation. It contains immense deposits of rock-salt and brine springs, and is hence sometimes called

saliferous, or salt-bearing. The name of *Poikilitic*, mottled or varied, has also been proposed, in allusion to the variegated colour of the strata. But the common denomination of the system is characteristic of its place in the geological series, of its prevailing hue, and of the composition of the predominant rock. It occupies a vast extent of the area of England, running in a thin and interrupted line from Torquay and the river Exe in Devonshire to the midland counties, where it acquires great expansion, stretching from the east of Nottingham, by Derby, Ashbourne, and Newcastle-under-Lyne to the borders of Wales. It divides into two branches in the midland counties. The east branch passes up the basin of the Trent, through Yorkshire, into Durham, forms there the east coast, and terminates southward of the Tyne. The west branch embraces almost the whole of Cheshire, and runs in a narrow, devious course from the Mersey, at Liverpool, through the centre of Lancashire, to the northern part of the county. There are several small detached districts, and a large outlier in Cumberland, which includes the whole plain of Carlisle. Many local names seem to have been originated by the prevailing red colour of the soil and rocks, as Rougemount Castle, in Exeter, now a prison; Redhill, Redcliff, and Radford in Somersetshire; Redbrook in Gloucestershire; Red Marley in Worcestershire; Retford, Redhill, Radford, and Ratcliffe in Nottinghamshire; Red Mire, Red Ho, and Red Bar Rocks in Yorkshire, the latter on the coast between Guisborough and Hartlepool. From its immediate contiguity to the coal measures, this great region has become one of our special sites of commercial and manufacturing activity, nineteen principal cities and towns, from Exeter to Carlisle, being situated on it. In Scotland, there are but slight traces of the same strata, apart from the Solway Firth, on the

English border. In the north of Ireland, they occupy a considerable area.

Rock-salt, imbedded in the marl of Cheshire, is chiefly found in the valleys of the Weaver and its tributary streams. The uppermost stratum lies at the depth of from thirty to fifty yards; but a much greater depth must be descended to reach the pure, white, serviceable mineral. Its presence is manifested at the surface by brine springs, from which a large quantity of salt is obtained, in addition to the amount raised from the rock itself. *Gypsum*, a sulphate of lime, one species of which is known commonly under the name of alabaster, occurs in the red marly banks of the lower Trent, and is wrought into columns, vases, and other ornamental objects.

Magnesian limestone, a compound of the carbonates of magnesia and lime in varying proportions, extends in a continuous band from the Tyne southwards through Yorkshire into the counties of Derby and Nottingham. Besides yielding, under chemical treatment, the magnesia of medicine, it forms the best of our building-stones, where the two components are united in nearly equal proportions. It is worked with facility and is as compact as crystalline rock, while, owing to the presence of the magnesia, it is unfavourable to the growth of that minute vegetation which is apt to fasten upon edifices. Some of our structures, still in fine preservation, are built of it, as Westminster Hall, York Cathedral, Beverley Minster, and Roche Abbey; and it was specially selected for the new Houses of Parliament, by a commission appointed to decide upon the material. The particular kind chosen and used is from the Bolsover-moor quarries, in Derbyshire.

Excepting portions of the magnesian limestone for-

mation which contain fossils, the whole of the district under notice is comparatively deficient in organic remains. It is, however, famous for its *ichnolites*, "foot-prints on stone," the tracks of animals upon the sandstones, discovered in the Cheshire quarries and other places. They are usually supposed to be the traces of reptiles allied to the frog and toad. The predominant red colour of the strata, already mentioned, is derived from oxide of iron; and the striking coincidence has been noticed, that all rocks in which this oxide prevails are similarly poor in fossils. In its external aspect the country is devoid of striking scenery, presenting no picturesque combinations of high cliff and deep ravine, but a series of levels dotted with round-topped hills and gentle ridges. But some of the finest pastures in the kingdom are within its range. Cereal and leguminous plants flourish upon the red marls; and even the soil of the magnesian limestone, though considered infertile, and really so where the former ingredient has prominence, is favourable in other circumstances to the growth of timber; and it specially suits the sweet-scented violet and yellow rose.

CARBONIFEROUS SYSTEM.—The coal-bearing strata, with accompanying millstone grit and mountain limestone, are by far the most valuable of our geological formations, giving us bright winter fires, brilliantly-lighted streets, iron roads, the staple of locomotive engines and locomotive power, ships which can plough the ocean against wind and tide, lead, silver, and zinc, building stone, implements for grinding corn, manure and cement, materials for elegant mantel-pieces and decorative works, with perpetually gushing, copious springs, and some rare gems of natural landscape,

"So wondrous wild, the whole might seem
The scenery of a fairy dream."

This remarkable section of the terrestrial structure derives its name from characteristic vegetable deposits, of which the main solid element is carbon. The vegetable origin of coal—in other words, that it is a mass of altered plants, has long been established beyond all possibility of doubt. Though, owing to processes of compression and bituminization which the mineral has undergone, traces of vegetable structure may not be discernible at first sight, they are very apparent upon subjecting thin slices to a microscope, or to the transmission through them of a powerful light. While, too, the external form of the plants has been obliterated in the mineral, detached fossil-trees—trunks, branches, and leaves—beautifully preserved in the associated sandstones and shales, sometimes in the coal itself, throw distinct light upon the nature of the carboniferous flora. Huge pines and stately araucarians, reed-like calamites, tall tree-ferns, punctured stigmariae and sculptured sigillariae, gigantic horse-tails, with club-mosses and other cryptogamia, only resembling existing plants in their generic distinctions, are prominent forms. It may not be out of place to observe, that the embedding of vegetable matter so as to exclude the air and prevent the escape of the gaseous elements released by decomposition from their organic combination, with pressure from above, are the main conditions necessary for the conversion of vegetable substances into coal. The product will be more or less perfect, either a highly bituminous coal-culm or peat-wood, according to the manner in which these conditions are fulfilled. Almost every summer we have stacks of newly-mown grass smoking from the fermentation pro-

duced by moisture and pressure, giving to the hay a darkened colour, an oily surface, with a bituminous odour, and ending in ignition, unless the process is arrested. Nor is it uninteresting to find that, in lakes and at the mouths of great rivers, enormous collections of drift timber, veritable islands of wood, extending for miles, are in the present day in process of formation. But some beds of coal appear to be wholly composed of delicate foliage, or minute leaves, as if shed and accumulated in forests; and, to a great depth in our existing pine districts, the soil consists of the spiny leaves, the droppings of a thousand generations.

No known portion of the globe of the same area possesses such vast stores of carbonaceous matter as Great Britain. South of the Tweed the coal fields are as follows : *—

I. NORTHERN DISTRICT.

* Northumberland and Durham, extending from the river Coquet on the north nearly to the Tees on the south, or about 48 miles, by an extreme breadth of 24 miles from the coast, dipping to an unknown extent beneath the sea. It includes an area of 723 square miles. Two navigable rivers intersect the district—the Tyne and the Wear.

Whitehaven, on the west coast of Cumberland, small but valuable, dipping beneath the sea.

North Lancashire, between Lancaster and Ingleton.

North Yorkshire, small insulated basins around Middleham and Leyburn.

* South Yorkshire, Nottingham, and Derby, extending from the north-east of Leeds to near Derby,

* The most important of these coal-fields are marked with an asterisk.

60 miles in length, by 26 in breadth, at the widest part.

* South Lancashire, stretching from the south-west of the county by Manchester and Rochdale, north to Colne, and north-west to Preston, 35 miles in length, by an average breadth of 6 miles.

North Staffordshire, the Pottery coal-field, north-east of Newcastle-under-Lyne, and an insulated basin near Chendale.

II. CENTRAL DISTRICT.

Ashby-de-la-Zouch, an irregular, dislocated area on the borders of Leicestershire and Warwickshire, the longer diameter of which is about 10 miles, the shorter 8.

Warwickshire, running from the neighbourhood of Coventry to that of Tamworth. 16 miles in length, by an average breadth of 3.

* South Staffordshire, extending from near Rugeley to near Stourbridge, about 20 miles, having its greatest breadth, from Walsall to Wolverhampton, about 7 miles.

III. WESTERN DISTRICT.

Anglesey, a valley intersecting the island in a direction parallel to the Menai Strait.

Flintshire, extending from the Point of Ayr, on the coast, to the neighbourhood of Oswestry, in Shropshire.

Coalbrook Dale, on the Severn, west of the Wrekin.

Plain of Shrewsbury, small detached patches, west of the Wrekin, and in other parts of Shropshire.

* South Wales, stretching through the principality, from Pontypool, in Monmouthshire, on the east, to St.

Bride's Bay, in Pembroke, on the west, upwards of 100 miles, the breadth averaging 18 miles in the central parts, and the area amounting to 1200 square miles.

Forest of Dean, between the Wye and the Severn, 10 miles long by 6 broad.

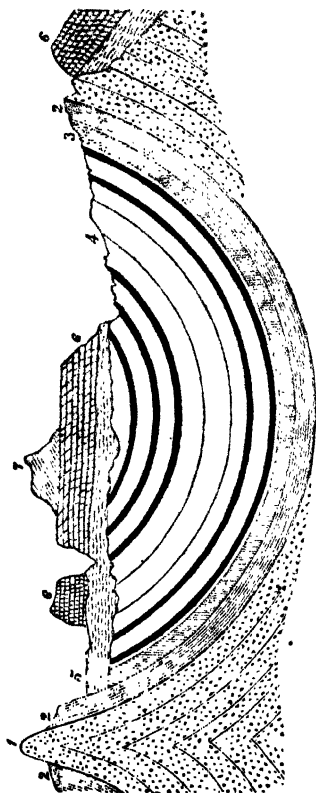
* South Gloucester and North Somerset, bounded by Totworth on the north, the Mendip hills on the south, Bath on the east, and Bristol on the west, 25 miles long by 11 broad.

In Scotland, the carboniferous formation extends across the island, from south-west to north-east, or from the coast of Ayrshire to Fifeness; and through the Lothians south and east of Edinburgh, detached tracts occurring in the counties of Berwick, Roxburgh, and Dumfries. In Ireland, coal is found in many of the southern and northern counties; but the workable beds are of inconsiderable extent, and the quality is commonly inferior. The total area occupied by the deposit in the United Kingdom is estimated at upwards of 8000 square miles; and the entire stock is supposed to be sufficient to meet the demand, at the present rate of consumption, for 2000 years.

The coal measures, as the immediate sites of the mineral are called, consist of numerous layers of variable nature and thickness, alternating with each other, shales, sandstones, ironstones, limestones, and coal. It is, in fact, from carboniferous strata that our supply of iron is derived. To separate the metal from its earthy admixture, a clay, fuel and limestone are essential; and hence it has been properly noticed as one of the beneficent arrangements of Providence, in distributing the rude materials of the earth, that the most useful of all the metals should be found in im-

mediate connexion with coal to melt the ore, and with the limestone which subjects the argillaceous matter in it, by itself infusible, to the action of fire. The position of the coal-seams is occasionally very highly inclined, owing to an elevating agency, which has thus rendered them more accessible to man, by bringing them nearer to the surface. The same agency has splintered and broken them in various directions, wholly interrupting their continuity, producing faults, the "up-throws" and "down-throws" of the miner, risings of the strata on the one hand, and sinkings on the other. The Newcastle coal-field is divided into two unequal parts by a great fault, crossing the district a little north of the Tyne, called the "main dyke" and the "ninety-fathom hitch," because the strata on the north side are thrown down, and elevated on the south side, by a perpendicular interval of 90 fathoms, equal to more than the height of St. Paul's. But viewed as a whole, omitting these dislocations, the coal measures commonly exhibit a trough or basin shape, the sides having been tilted up by the subjacent masses, as in the annexed section of the Bristol coal-field. This arrangement is of great utility, for the concave bendings of the strata obviously bring them nearer to the hand of the miner, and closer to our own firesides.

The physical aspect of the coal-fields is generally tame and unprepossessing; the soil is unfertile; nor have natural appearances been improved by the useful operations in process in the districts. But the other members of the system, the *millstone grit* and *mountain limestone*, exhibit scenery of a bold, striking, and romantic character. The *grit* comprises very pebbly quartzose sandstones, distinguished by their great hardness; and it is often used for millstones, from which



Mendip Hills.

SECTION OF THE BRISTOL COAL-FIELD.

- | | | | |
|------------------------|--------------------|-----------------------|---------------------|
| 1. Old Red Sandstone. | 3. Millstone Grit. | 5. New Red Sandstone. | 7. Superior O-lite. |
| 2. Mountain Limestone. | 4. Coal Measures. | 6. Lias | |

the name is derived. It is extensively developed in northern and central England; and has long been used for building purposes, as in Durham Cathedral, the keep of Richmond Castle, Ecclestone Abbey, and modern erections in the towns of Durham, Newcastle, and Leeds. It but feebly appears in the south-western carboniferous districts, but occurs in great abundance in Ireland, in the mountains around Enniskillen. This rock commonly forms the surface of elevated moorlands, covered with a vegetation of brown or purple heaths, mosses, and groups of dark pines; and it often occurs as a kind of cap to insulated mountains of shale, from which it projects abruptly, forming remarkably bold escarpments, as at the top of Stonnis and Kinderscout, in Derbyshire.

The *Mountain limestone* is so named from being frequently developed with us in ranges of considerable height and magnitude, as in the central chain of England, extending from the Scottish border to the basin of the Trent, and in the Mendip hills. It occupies an extensive space in Northumberland, Durham, Yorkshire, and Derbyshire, appears in the western counties, and in Wales, and is remarkable for the abundance and variety of its fossils of the encrinite family, whole masses of rock being almost entirely composed of them. The beds are sometimes so hard and crystalline as to furnish a marble for ornamental purposes equal to foreign samples; and the best lime for the builder, the agriculturist, and the metal-smelter is obtained from this formation. It is also the chief repository of lead-ore, with which silver is occasionally associated in sufficient quantity to repay extraction; and zinc is another metallic accompaniment. Though not much known in Scotland, the mountain limestone forms the greater

part of Ireland, but there it composes the plains and broadly undulating interior of the island. It occurs more extensively in the United Kingdom than in all Europe besides. Almost all the grand examples of caverns are peculiar to it; and scenery of great beauty rewards the tourist to its hills. The romantic rocks of Cheddar, at the base of the Mendips, the heights on each side of the Avon near Bristol, the picturesque cliffs of the banks of the Wye, near Monmouth, the bold tors of the Peak, Matlock valley, and Dove-dale are characteristic examples. A general verdure, remarkable for its freshness, is found in the valleys; springs gush from the base of the hills, which vary very little in their quantity in drought or after the heaviest rains; and the highlands are clothed with natural pastures of short succulent grass, upon which the rural music of the sheep-bell is perpetually saluting the ear.

OLD RED SANDSTONE SYSTEM.—Arenaceous beds distinguish this series, and hence the name,—the term “old” discriminating its geological place from that of another series of sandstone; and “red” denoting the predominant colour of the strata, which varies from a dark brick-red to brown and a cream yellow. The principal divisions are locally called *tilestones*, a fissile formation which splits into tiles, and is extensively quarried, seen at Pont-ar-Lleche, the “bridge on the tiles,” in Caermarthenshire; *cornstones*, consisting of concretions of impure calcareous matter, used for the repair of roads; and vast masses of *conglomerate*, comprising pebbles of quartz, varying from the size of hazel-nuts to cannon-balls, well developed on the right bank of the Wye, in the neighbourhood of Tintern Abbey. The fossils are of singular interest, chiefly

uncouth-looking crustaceans and fishes of the vertebrated order, furnished with fins, tails, and scales. These deposits appear largely in Devonshire, occupy the greater part of Herefordshire, spread over wide tracts in the adjoining counties of Monmouth, Worcester, and Salop, and are displayed upon an immense scale in Scotland. They extend along the line of the Grampians in an unbroken bar across the kingdom from the east coast at Stonehaven to the Firth of Clyde; form two large bands on each side of the Moray Firth, stretching far into the great Caledonian valley; and are found on the opposite shores of Sutherlandshire and Caithness. Districts of the old red sandstone are marked with lofty ranges of hills, as the Brecon and Caermarthen Fans in Wales, the Ochills and Siddlaws in Scotland, which exclusively belong to this formation. But through considerable spaces the strata lie flat, or nearly so, forming a slightly varied surface. Where sand prevails in the soil it is singularly unproductive, as at the far-famed heath of Forres, but associated with marls and lime it becomes as remarkably rich. Hence the "apple-tree soil" of Herefordshire, with its orchards, hop-grounds, and goodly meadows upon which its celebrated cattle are pastured.

SILURIAN SYSTEM.—Argillaceous compounds mingled with limestones and sandstones compose this peculiar and highly interesting geological region. The name is derived from the geographical Siluria, where these strata are most distinctly developed, the country of an old British tribe, the Silures, who occupied a portion of South Wales, with parts of the border counties of England, and maintained a gallant struggle with the Romans. The Caradoc Hills in Shropshire

preserve the memory of the brave and unfortunate chieftain of that name, the Caractacus of history; and Siluria still denominates a farm in the centre of the district. The series of rocks termed from it extends southward in the form of a crescent from the beautiful vale of Clwydd by Llangollen to the borders of Herefordshire, and thence westward to the extremity of Pembrokeshire, terminating at St. Bride's Bay. There are outliers in the counties of Monmouth, Gloucester, and Worcester; and the same rocks are obscurely recognised in Devon, more prominently in North Yorkshire, Westmoreland, the south of Ireland, and largely abroad. The characteristic fossils are trilobites, three-lobed crustaceans of a family which has no known living representative. So numerous and distinctive are they, that Silurian rocks have been styled the "great trilobitic series," the "grand mausoleum of these ancient beings." A woody ravine, near Welshpool, so abounds with them, that the name of the Trilobite Dingle has been given to it.

CLAY-SLATE SYSTEM.—This vast and valuable series is composed almost entirely of argillaceous masses, distinguished by the fine grain, hard texture, and fissile structure so well known from the universal employment of slate for economical purposes, as writing, roofing, and paving. Our supplies of tin and copper are chiefly obtained from these rocks. Organic remains are few, consisting of shells and corals, and are wanting altogether in the lower beds. Slate rocks prevail largely in Cornwall and Devon, North Wales, Anglesey, and Man, and nearly the whole of the lake district of Cumberland, Westmoreland, and Lancashire is formed of them. They are extensively displayed in the Lam-

mermoor Hills and the connected ranges which run through the south of Scotland, from St. Abb's Head, on the east coast, to Port Patrick, on the west, and are principal components in some of the mountain systems of Ireland. The slate districts have a striking, and often a very magnificent, physiognomy. The rocks rise to grand elevations, more than three thousand feet, and form, in Sca Fell and Snowdon, the highest points of land in England and Wales. Variety of outline and intricacy of combination, with enormous crags and fearful precipices, clear, quiet lakes and roaring cascades, with valleys sometimes richly wooded and watered, distinguish the style of landscape. The Cambrian slate region excels in point of picturesque beauty, owing to the frequent grouping of rock, water, and wood. The Cambrian is pre-eminent for majestic proportions and deep effective colouring.

MICA-SCHIST AND GNEISS SYSTEMS.—The two are classed together; for, while possessing distinct features, they have common characters. Both are siliceous, non-fossiliferous, and stratified crystalline rocks, and have undergone a change of form by subjection to a high temperature, whence they are termed metamorphic. *Mica-schist* is essentially a compound of mica and quartz; and varieties result from either of the two ingredients preponderating, also from admixture with other materials. England and Wales have no important examples of it, but it extends across central Scotland, occupying an estimated area of from three to four thousand square miles; and it occurs in the north-west of Ireland. To indicate its scenery, it will suffice to name Ben Lomond, Killiecrankie, Loch Katrine, the Trosachs, and the fantastic ridges of Glencoe. The schist, though

used for roofing, in the absence of a better material, has little economic value. *Gneiss* is a compound of mica, quartz, and felspar, the constituents of granite, but less entire, as if water-worn. Though scarcely known at all in south Britain, it occupies an immense space in central and northern Scotland, and composes the Outer Hebrides, filling an area estimated at from nine to ten thousand square miles. It forms in general a most unpicturesque country, without variety of feature or strength of outline, presenting rounded protuberances and flat valleys, the former clothed with brown heaths, and the latter full of stagnant waters overgrown with moss. *Quartz*, an element of the two systems, often forms extensive masses by itself, composing nearly the whole of the islands of Islay and Jura, and occurring in large patches in Sutherlandshire. The districts where it abounds have smooth conical hills, with numerous fragments scattered over them, remarkable for severe sterility in a land of barrenness, their summits and declivities refusing nourishment to the humblest moss, and shining in the sun with dazzling whiteness. Balloch-nan-fey, the last remarkable mountain on the west coast, a naked ridge of bright quartz, glitters in the sunbeams like snow, and was mistaken by Pennant for marble.

THE UNSTRATIFIED ROCKS.

The formations of this class, which are all non-fossiliferous, consist mainly of granite and trap rocks.

GRANITE, highly crystalline, and always massive and irregular in its structure, is a compound of quartz, felspar, and mica, ingredients which vary the texture and colour of the rock, according to their fineness or coarse-

ness of grain, and their hues, and as one or more of them may be most prominent. It appears in Cornwall, Devon, the Malvern Hills, North Wales, Charnwood Forest, and the English lake districts; but the entire area occupied by it is limited, not amounting to more than 300 square miles; whereas in Scotland the estimated area is upwards of 1,750. It occurs in the greatest abundance in the Grampians and the Isle of Arran. The Wicklow and the Mourne mountains are the chief Irish localities for granite. While rising to the greatest heights, this rock seems to go down to the lowest depths, and to be a kind of foundation rock upon which all the stratified systems repose, being thus the floor of that temple which the Almighty has filled with so many demonstrations of his power, wisdom, and beneficence. Sometimes one of the constituents of perfect granite is entirely wanting and without a representative, as in graphic granite, a binary composition of quartz and felspar, mica being absent. This variety is called graphic from the two ingredients being so arranged as to give to the surface of the rock, upon being polished, the appearance of a slab inscribed with rudely-formed letters. It is found in the remarkable locality of Portsea, on the coast of Banffshire, in a vein which traverses mica-slate. In more numerous instances, where mica is absent, its place is supplied with hornblende, the compound constituting sienitic granite. In the Malvern Hills, and those of Charnwood Forest, perfect granite is frequently found passing into sienite in the same bed.

On account of its extreme hardness, granite is largely employed in structures where great durability is aimed at, as in docks, piers, lighthouses, and bridges. Reddish, flesh-coloured granite forms the coping-stones of

Waterloo-bridge, and immediately close to them is the whitish variety in the balustrades. Tin occurs in the granite of Cornwall, as well as in the slate, and ornamental stones, as the topaz, beryl, and fluor spar are found in cavities of this rock. Ben Macdhuil and Cairngorm, two of the loftiest of the Grampians, have supplied large and magnificent specimens of rock crystal, and once brought a considerable rental to the proprietor for liberty to search for them. Felspathic granite, a variety in which felspar is the prime constituent, is readily decomposed by the action of the atmosphere, producing a fine powder, which the rains carry down into the valleys and accumulate in beds of clay. This is the porcelain clay of the Chinese. It occurs near St. Austel, in Cornwall, and many thousand tons of the material, decomposed felspar, called Cornish clay, are annually sent to the Staffordshire Potteries.

The TRAP-ROCKS, which comprise the basalts, porphyries, and their associated substances, are so called from the Gothic word *trappa*, a stair, in allusion to their frequent arrangement in tabular masses, rising one above another like terraces or stairs. Their chief localities are the vicinities of Durham and Dudley, in England; the neighbourhood of Edinburgh, the Highlands, and Inner Hebrides, in Scotland; and the county of Antrim in Ireland. Their respective areas are calculated at about 250 square miles in England, 800 in the north of Ireland, and 2,750 in Scotland.* While the step-like disposition of the trap-rocks is common, the columnar arrangement is also characteristic, being frequently exhibited by basalt

* Confining attention exclusively to Great Britain, it is supposed that of the 89,600 square miles of its surface, all the unstratified formations put together do not occupy more than 5,000 square miles, or about one-eighteenth of the entire superficies.

and greenstone, and forming objects of great popular interest. The columns are regular prisms, with sides varying in number from three to eight, but they are usually pentagonal, in a vertical, inclined, or horizontal position. Seen from above, when vertical, the tops appear like a pavement artificially constructed of pentagonal pieces



1. Vertical Basalt.
2. Horizontal Basalt.

3. Waterworn Basalt.
4. Upper Surface of Basaltic Column.
L 2

of stone, nicely fitted to each other. Viewed in the same position, but from a horizontal direction, the columns seem at a distance like a grand monument of human architecture, or a ruined building, in situations where they have been exposed to the destructive dash of the ocean.

Basaltic columns extend for several miles along the north coast of Ireland, and form the extraordinary promontory called the Giant's Causeway. Here three distinct natural piers or quays project from the base of a towering, precipitous cliff, the chief of which is above a thousand feet in length at low-water. They consist of polygonal stone pillars, from forty to fifty-five feet long, having from three to eight sides, but those with six sides are by far the most common. The surface formed by their summits is a smooth platform, for they are so closely joined together that a knife can hardly be introduced between them. The same kind of columns, though of a less perfect form, are finely displayed in the neighbouring headlands of the shores, particularly at Pleaskin, one of the capes of Bengore Head. Under a thin grassy sod at this point lies the natural rock, which assumes the columnar arrangement at the depth of ten or twelve feet, and forms a range of massy pillars standing perpendicular to the horizon, and giving to the sharp face of the promontory the appearance of a magnificent gallery or colonnade upwards of sixty feet in height. The colonnade rests upon a base of coarse, dark, irregular rock, nearly sixty feet thick, under which there is a second range of pillars, not quite so high as the former, but of finer texture and more sharply defined. This lower story rests upon a base of red ochre stone, which serves as a striking contrast. The two galleries, with the intervening

irregular mass, form a perpendicular height of 170 feet, from the base of which the rock slopes down to the sea, for the space of 200 feet more, making, in all, a mass nearly 400 feet high. In beauty and variety of colouring, in novelty and grace of arrangement, and in the magnitude of its forms, few natural objects surpass Pleuskin.

The stratified and unstratified rocks of the British Isles supply, with a few trifling omissions, a complete epitome of the whole series of inorganic substances which compose the solid surface of the globe. Thus, within the comparatively limited extent of a few hundred miles, we have comprised such formations, with their advantages, as in other less favoured regions are spread over extensive areas, and therefore widely separated, while in many countries some of the more important deposits are not found at all. The utility of the inorganic substances in the economy of life is obvious—as sandstone for building, limestone for cement, slate for roofing, the clays for bricks and earthenware, with the metals for a thousand appliances of civilized existence, and coal for fuel. Upon these adaptations the high argument may be grafted, that He who has “given the earth to the children of men” both bountifully and wisely prepared it for their accommodation; for while the materials needful for their comfort are provided in the most liberal manner, industry is required to render them available, and ingenuity is sharpened by the effort to profit by them to the fullest extent in the shortest time. The external world declares the goodness, wisdom, and power of God as undeniably as that he exists. Still the declarations of nature upon the point are qualified by the existence of

many positive evils, which, unexplained in respect to their cause, would press upon us the wretched belief in a God of partial benignity, limited intelligence, or circumscribed power. But from all surmisings of this kind we are effectually secured by the testimony of Revelation, which furnishes the true key to the present condition of man as the inhabitant of a world stored with dangerous as well as beneficent elements, furnished with sterile wastes and flowery meads, torn by the volcano and shaken by the earthquake, while teeming with the materials of prosperity and peace. We are not under a dispensation of unmingled good, by reason of sin; nor yet under one of unmixed severity, because, so far from being hopelessly condemned, the means have been provided for the restoration of sinners to acceptance and favour with a God of justice. He "so loved the world, that he gave his only begotten Son, that whosoever believeth in him should not perish, but have everlasting life."* This provision is the highest evidence of the Divine care, and meets the most urgent of human necessities. But it should be well understood and solemnly weighed, that, just as it is thankfully embraced or ungratefully despised, the world that now is becomes the way to a better country; that is, a heavenly, or the road to a more terrible destruction.

In the solid materials of the globe accessible to observation, the operation of two agencies, fire and water, is abundantly evident. The stratified rocks, in which the remains of plants and animals are embedded, plainly consist of detritus deposited in water, while their frequent elevations and dislocations, with the crystalline structure of those which are unstratified,

* John iii. 16.

indicate an igneous agency. The inspired writers, in glancing at the physical history of the earth, take cognizance of the action of both these formative causes. "And God said, Let the waters under the heaven be gathered together unto one place, and let the dry land appear : and it was so."* The mode in which the great change was effected is not described, but the recession of the fluids from the general surface into particular basins—apparently a more or less sudden operation—intimates the upheaving of a portion of the underlying land by an agency analogous to that which appears in existing volcanic displays, causing the floods to retire into the beds which the elevations produced. So, in the days of Noah, when the fountains of the great deep were broken up and the waters prevailed upon the earth, the elevation and subsequent depression of their bed, or the subsidence and upheaving of the land overwhelmed—changes which point to igneous agency—seem involved in the record of the catastrophe. "Thou coveredst it with the deep as with a garment: the waters stood above the mountains. At thy rebuke they fled; at the voice of thy thunder they hasted away."†

Divine revelation anticipates and announces a period when the earth shall be burned up, and its elements be dissolved with fervent heat, new combinations following, and a more glorious constitution. If the announcement refers to the ordeal of material fire, we know, from current tremendous displays of volcanic eruption, that the instrument is in being, in such force as to bring on the event whenever the Almighty Governor shall be pleased to call it into action. "But of that day and hour knoweth no man, no, not the angels of heaven."‡ Yet assuredly it will come, and in con-

* Genesis i. 9.

† Psalm civ. 6, 7.

‡ Mark xiii. 32.

nexion with it the second advent of the Saviour, and the final judgment of the human race. "Who may abide the day of his coming? and who shall stand when he appeareth?" * None but those who have trusted in him as their Saviour, owned him as their Lord, and obeyed him as their Master. Such may adopt the triumphant language of the poet :

"Stand the omnipotent decree:
 Jehovah's will be done.
 Nature's end we wait to see,
 And hear her final groan.
 Rests secure the righteous man,
 At his Redeemer's beck,
 Sure to emerge and rise again,
 And mount above the wreck.
 Lo! the heavenly spirit towers,
 Like flame o'er nature's funeral pyre,
Triumphs in immortal powers,
 And claps his wings of fire."

* Malachi iii. 2.

CHAPTER V.

HIGHLAND AND LOWLAND REGIONS.

Distinct Aspects of England—Mountains and Hills—Pennine Chain—Cross Fell—The Peak District—Caverns—Cumbrian Mountains—Sca Fell Pikes, Helvellyn, Skiddaw—South Western Highlands—Dartmoor and Exmoor—Mendip and Cotswold Hills—Chalk Ranges—Bardon Hill—Welsh Mountains—Snowdon—Cader Idris, Plinlimmon—Malvern Hills—Southern Highlands of Scotland—The Grampians—Ben Lomond, Schiehallion, Ben Cruachan—Moor of Rannoch—Ben Nevis—Ben Aven, Cairngorm, Ben Macdhui—Northern Highlands—Mountains of Ireland—Vales of England—Valleys and Dales—Cheddar, Dovedale—Plains—Great Level of the Fens—Its Aspect and Structure—Great Plain of Ireland—Peat Bogs and Mosses—Utility of Superficial Diversities.

A FOREIGNER, upon a visit to the kingdom, confining himself to the eastern and central counties of England, and uninformed respecting the remainder, would leave its shores with the impression that it was a gently undulating country, marked with a few bluff hills and headlands, stamped with features everywhere expressive of decided amenity, being closely overspread with a network of trim hedge-rows, while occupied by an agricultural and pastoral people, with the exception of those in the capital, the ports, and some principal inland towns. But another, who landed at Penzance, passed through Cornwall and north Devon into Wales, traversed the Principality, proceeding through Lancashire into Cumberland, would see little of

“ Corn-waving fields, and pasture green, and slope
And swell alternate,”

in comparison with bleak heights and wild moorlands,

often intersected with stone walls ; and would conceive himself in a region but thinly occupied throughout extensive tracts with hard-faring mountaineers, while densely crowded at intervals with hard-working miners, and a busy manufacturing population. In fact, a line commencing at the mouth of the Exe in south Devon, and drawn northwards with moderate curvatures to the mouth of the Tees in Durham, divides England into two principal sections, possessing a definite and distinct natural physiognomy—a generally rugged and occasionally mountainous tract, lying on the south-west, west, and north-west, and a more extensive district of gentle elevations, broad river-vales, intermingled with plains, on the east. Such a line will also separate the decidedly agricultural classes on the east from the mining and manufacturing on the west ; for all the coal deposits, with the metalliferous ores, except iron, are on the western side of the line.

MOUNTAINS AND HILLS.

The term mountain is used with considerable latitude. It denotes elevations in one country which in another abounding with those of a superior class are of very subordinate rank. With us, it may with some propriety be attached to eminences ranging 2000 feet and upwards above the level of the sea, regarding those which are below that standard as hills, secondary hills, and slopes. The slighter acclivities, whether crowned with grove and forest, waving with cereals planted by the cultivating hand of man, or clothed with natural grasses, are always pleasing features of the surface ; but the loftier projections, stamped with an air of dignity, as if claiming

the sovereignty of the territory they overlook, and indicating an upheaving power of irresistible might in their construction, captivate, excite, and impress the imagination. Whether fringed with the dark green pine, coated with moss, or lifting their naked brows as if in reverence of that invisible Superior who "weigheth the mountains in scales and the hills in a balance," they are wonderful examples of the diverse forms by which the ideas of majesty and might may be expressed. It is a delightful recreation to men of thought and cultivated taste, to wander far away from haunts of the crowd, leave the solitary huts of shepherds behind them, and, ascending the steep mountain, mark from the ruinous cairn that crowns its summit the subjacent landscape, the drifting clouds, and the ptarmigan gleaning his Alpine food. In such a situation, the Christian will commune with his own heart, and, while a lover of nature, will look up to nature's God. Mr. Macgillivray, the naturalist, properly remarks: "To me the ascent of a lofty mountain has always induced a frame of mind similar to that inspired by entering a temple; and I cannot but look upon it as a gross profanation to enact, in the midst of the sublimities of creation, a convivial scene, such as is usually got up by parties from our large towns, who seem to have no higher aim in climbing to the top of Ben Lomond or Ben Ledi than to toss as many stones as they can find over the precipices."

The mountainous and prominently hilly region of England, including Wales, extends on the western side of the island, though with several interruptions, from the Scottish border to the Land's End, approaching the east coast in the wolds of Yorkshire, and advancing towards the centre of the country in the hills of Derby-

shire. It comprises the Pennine chain, the Cumbrian or lake mountains, the Devonian or south-western Highlands, and the high ranges of Wales, with detached ridges and eminences. Though mere hillocks when compared with the great continental masses, they are rich in effective scenery of the highest class, for magnitude is not essential to beauty, nor is sublimity always to be measured by yards and feet. A mountain may be loftier and more massive, a lake longer and wider, a ravine deeper and more difficult, without any gain to picturesque effect, which mainly depends upon form, grouping, colouring, and alliance with woods and waters.

The **PENNINE CHAIN**, a somewhat ambitious title, is locally known by the homely style of the "back-bone" of England. It traverses the northern counties, in the direction of the island's length, from north to south. Starting from Carter Fell, one of the Cheviots, near the sources of the Upper Tyne, on the frontier of Scotland, it runs southwards upwards of 200 miles, in a tolerably direct line, and sinks down into the great central plain of the kingdom towards the middle of Derbyshire. It forms the watershed, separating the basins of the Tyne, Tees, and Yorkshire Ouse, flowing eastward to the North Sea; from those of the Eden, Lune, Ribble, and Mersey, which travel westward to the Irish Sea. The range has no well-defined continuous ridge-line, but consists of a series of huge moorlands, from ten to twenty miles broad, cut up with valleys, and irregularly interspersed with mountainous masses. Towards the northern extremity, a depression occurs, which is traversed by the line of the old Roman wall, and that of the Newcastle and Carlisle railway, the summit level of which is only 446 feet. But the ground speedily

resumes its elevated character, and attains its highest point in Cross Fell, towards the junction of Cumberland, Westmoreland, and Durham. This mountain rises to the height of 2901 feet, and is the loftiest mass of limestone in the kingdom. The south Tyne and the Tees take their rise from a swamp on the eastern slope. From the summit, in fine weather, the seas on the opposite shores of the country are visible. The snows of winter remain long upon the crest, and have continued unmelted through the summer. A spring of very clear cold water occurs near the top.

In its progress through the west of Yorkshire, the chain has several conspicuous heights with very massive trunks and bases, as Mickie Fell, rising 2600 feet, Wharnside, 2385, and Ingleborough, 2361, the base of which is thirty miles in circumference, and Pennigant, 2270. In Derbyshire, which has its so called "Peak," the heights are lower, nor is there a single point, "in shape and gesture proudly eminent," answering to the name, though Kinder Scout, Axe Edge, and Mam Tor, the most elevated heights, are locally prominent. Yet the district is very remarkable for the extremely romantic character of its valleys and dales, with the grand caverns that open on their sides. Some of the village churches occupy higher ground than any others in the kingdom: and the highest of our iron roads is the Cromford and High Peak railway, which rises 990 feet above the level of its starting-point, and 1290 above the sea. Holme Moss, a mass of deep peat resting on grit, at the junction of Derbyshire, Cheshire, and Yorkshire, is crossed by the turnpike road from Stockport to Huddersfield, at the elevation of 1859 feet, a greater height than any road southward of it in England.

Cavern formations are characteristic of the whole

range, owing to the soluble nature of the predominating limestone, and the abundance of water, which, in many instances, percolates copiously through the rock, and appears in its interior in the form of dark pools and streams. These hollows are often very striking from their seclusion and gloom—their fantastic architecture—the effect of torch-light upon the numerous crystallizations—the augmentation of sound and its reverberation—together with the stalactites and stalagmites, depositions of carbonate of lime, hanging from the roofs, or rising up from the floors. *The Peak* cavern in Castleton dale is the grandest example. It is approached between two ranges of perpendicular rocks, with a little rivulet flowing in the centre, which issues from the cave, and pursues its course over broken masses of limestone. The mouth assumes the form of a depressed arch, a hundred and twenty feet in width and forty-two in height. The excavation consists of a series of great chambers connected by narrow passages, some of which must be threaded in a stooping position. At one point, where a pool occurs, the overhanging rock approaches so close to the surface of the water that the passenger has to lie full length in a skiff, while the guide wades and pushes him across. The entire extent of the great cavity is nearly half a mile; and some of its halls are from forty to fifty yards high. The *Caves of Ingleborough*, in the West Riding of Yorkshire, have long been known; but the exploration of the most remarkable is an event of the present day. This was effected by breaking through a barrier of stalagmite, which had before been supposed to mark its termination, at about eighty yards from the entrance. Access was thus gained to a series of spacious excavations and contracted passages, which penetrate the

mountain to a distance equal to those at Castleton, and were not fully threaded till two years had been spent in the task of opening the way. But the entire extent is unknown, owing to a deep pool prohibiting farther progress. At considerable personal hazard, Mr. James Farrer, the leader of an exploring party, swam across this dark lake, with a candle in his cap, and a rope round his body, but found advance on the opposite side impracticable.

THE CUMBRIAN, OR LAKE MOUNTAINS, though connected with the preceding chain, have quite a distinct geological constitution, and acquire a character superior to that of a lateral offset by their greater elevation. They extend from the narrow valley through which the Eden descends from its source to Kirkby Stephen, nearly due west towards the Irish Sea, terminating at a little distance from the coast, and occupy about a third of Cumberland, a fourth of Westmoreland, and a small part of north Lancashire. The group where the greatest expansion occurs is about thirty-five miles across from east to west, by thirty-seven from north to south. Varieties of slate constitute the main masses, intersected with dykes of trap rocks, and associated with granite and sienite. Their appearance is strikingly different from that of the components of the limestone longitudinal range. The latter have in general a rounded and tame outline, a dreary, bleak, and desolate aspect, being largely covered with peat-earth and heath, while the slate mountains are steep, bold, and angular, ornamented in parts with wood, and extensively clothed with a fine green sward, except at great heights. Deep valleys and numerous lakes winding in every direction diversify the scenery, and effectively contrast with the gigantic forms around them. The grand elevations

are *Sca Fell Pikes*, the highest summit, 3,166 feet above the sea; *Helvellyn*, 3,055; and *Skiddaw*, 3,022.

Sca Fell, eleven miles to the south of Keswick, and about the same distance west of Ambleside, is a mass of clay-slate crowned with trap porphyry. The highest point, called the Pikes, and also the High Man, is distinguished by a lofty pile of stones and wood. Such monuments, raised by the people of the district, are commonly found on prominently elevated sites, and called "men." But this one, having been erected for the trigonometrical survey, is of unusual height, and marks the highest point of England. The snow lies here for six or seven months in the year, though not so long as on Cross Fell, owing to the more inland situation of the latter. The whole coast from Anglesey to the Mull of Galloway is visible. Half-way between, the lofty hills of the Isle of Man are seen; and on one of those rare days of bright sunshine without haze in the air or cloud in the sky, the hills of Ireland rise dimly on the horizon. "On the summit of the Pike," says Mr. Wordsworth, "which we gained after much toil, though without difficulty, the stillness seemed not to be of this world. We paused and kept silence to listen, and no sound could be heard; the *Sca Fell* cataracts were voiceless to us, and there was not an insect to hum in the air. Round the top not a blade of grass is to be seen. Cushions or tufts of moss, parched and brown, appear between the huge blocks and stones that lie in heaps on all sides to a great distance, like skeletons or bones of the earth not needed at the creation, and there left to be covered with never-dying lichens, which the clouds and dews nourish, and adorn with colours of vivid and exquisite beauty. Flowers, the most brilliant feathers, and even

gems, scarcely surpass in colouring some of those masses of stone, which no human eye beholds, except the shepherd or traveller be led thither by curiosity."

Helvellyn, on the borders of Cumberland and Westmoreland, though lower, has more colossal proportions, and is, in point of bulk, the monarch of the Lake mountains. But, being closely hemmed round by a giant brood, there is scarcely a point of view which embraces its entire mass. It may be ascended with ease on one side; but to see the mountain in its grandeur, the route by the Red Tarn must be taken by the tourist. This is a small pool at the height of 2,400 feet, between two walls of rock, called the Striding and Swirrel Edges. A steep and jagged pathway lies on the top of these walls, either of which may be followed; but both are so narrow that a passenger may drop a stone from each hand at once down precipices of some hundred feet on each side of him. It was here that the remarkable instance of brute fidelity which has been commemorated by both Wordsworth and Scott was shown by a dog, that for three months watched beside the corpse of his master, who had fallen and perished on a snowy day, while attempting the passage:

"How nourish'd there for such long time,
He knows who gave that love sublime,
And gave that strength of feeling great
Above all human estimate."

Skiddaw, a few miles to the north of Keswick, and the head of Derwentwater, though of inferior height and dimensions to the other two, forms a nobler object, having the advantage of being comparatively detached, so that its entire proportions may be seen from almost any direction.

The DEVONIAN, or SOUTH-WESTERN HIGHLAND REGION, occupies the angular projection of England from the west of Somersetshire to the Land's End. This district contains no extensive definite chain, but a series of bleak, rugged ridges, and a mountainous character is only assumed at a few points. The grand plateau of Dartmoor, in South Devon, and the elevated mass of Exmoor, in the north of the same county, are two of the most remarkable tracts in the kingdom.

Dartmoor is a vast granitic formation, extending about twenty-five miles between Exeter and Plymouth, by the same distance in the opposite direction. It has a mean elevation of not less than 1,400 feet, with projections which rise in Cawsand Beacon to 1,792 feet, and in Yestor, near Okehampton, to 2,077 feet. The surface is wildly irregular and dreary in the extreme, presenting a succession of craggy rocks, narrow valleys, and peat swamps, with blocks of rifted granite scattered about in every direction, some of which are of enormous dimensions, and have been moulded by the weather into impressive or fantastic forms. The plateau has a gradual slope on the northern side, but is steep on the south; and after heavy rains, when every furrow becomes the bed of a headlong torrent, "the sound of many waters," "deep calling unto deep," is emphatically realized. The Dart, the Teign, the Tavy, and the Plym, rise upon the moor and flow to the south coast, giving their names to places at or near their respective embouchures, as Dartmoor, Teignmouth, Tavistock, and Plymouth. This great "Devonshire wilderness" and "wild forest ground," as Leland called it, appears to have had extensive woods in ancient times, from the number of trunks, branches, and roots, chiefly oak and birch, that are found in

the bogs. The old trees are gone, except a scrubby remnant at one point, little more than seven feet high, overrun with moss, brambles, and parasitical plants. Part of the district, belonging to the crown, the site of a great prison, still bears the name of Dartmoor Forest, and has been extensively planted. But generally trees and dwellings are entirely absent; and the stillness, the want of life and activity, the severe yet dignified expression of the granite ridges and "tors," with the strangely scattered blocks, and some stone circles, monuments of the Druidical age, are impressive features of the scenery.

Exmoor is a corresponding tract in its aspect, of smaller extent and lower height, but quite as bare, bleak, and desolate, and containing large peat swamps. The moor is part of the high ground which presses close upon the Bristol Channel, forms the romantic scenery of Lynton, extends from near Ilfracombe to Bridgewater under various names, and culminates in Dunkerry Beacon, Somersetshire, at the height of 1,668 feet. The Black Down Hills, the Mendips, and other ridges of the latter county are offsets of the south-western highlands, and the Cotswold Hills, in Gloucestershire, may be regarded as a remote outlier. The Mendips form a very definite ridge, extending north-west from Shepton Mallet, about twenty miles in length by five in breadth, but nowhere rising above 1,100 feet, though commanding very varied and extensive views. The Cotswolds, a rather higher range, run through Gloucestershire in the direction of its length, and divide the basin of the Severn from that of the Thames. They rise abruptly from the plain of the former river, and overlook an immense extent of its course. Bounding the Severn valley, on the opposite

side, are the Malvern Hills, a beautiful and loftier ridge, which, with the heights of Salop, are outlying portions of the mountain system of Wales.

Broad and fertile river-valleys, hills of moderate elevation, some high, dreary wolds and heaths, a few marshes, and a great extent of comparatively level country, but generally stamped with an agreeable diversity, form the remainder of the surface of England, and by far the greater portion of its area—the country eminently of the daisy, the cowslip, and the primrose, of the oak and elm, the hawthorn hedge, the hazel copse, and woodbine bower.

From *Salisbury Plain* three ranges of chalk hills diverge in an east and north-east direction, cut up into separate masses by transverse valleys, presenting rounded summits, with one side steeper than the other, a characteristic of the chalk. Near the common nucleus, the Inkpen Beacon rises 1,011 feet, being the loftiest point of the surface south of the Trent, and east of the basin of the Severn. The most southern range crosses Hampshire by Winchester into Sussex, where it forms the celebrated sheep-walk of the South Downs, and terminates on the coast at Beachy Head. The second range intersects the north of Hampshire, and passes through Surrey, by Farnham and Guildford, into Kent, where it is known as the North Downs, extending to the east of the county. Between the two towns mentioned, the ridge bears the name of the Hog's-back, being continuous and narrow; and southward, the lower green sand of the chalk formation coming to the surface, forms the excessively dreary district, producing only furze and heath, which every traveller by the old main road from London to Portsmouth viewed with surprise, lying at no great distance

from the greatest capital in the world and its chief naval establishment. The third range follows a wavy north-east course into Norfolk, taking the name of the Chiltern hills in Oxfordshire, and the Gogmagog hills in Cambridgeshire; but greatly declining in height in the eastern counties.

Towards the centre of the kingdom, between Leicester and Ashby-de-la-Zouch, the craggy pinnacles of Charnwood Forest are conspicuous—a district now bare of wood, but retaining its ancient designation. Though of inconsiderable height, they arrest attention by abruptly rising from a widely extended plain, with a very distinct and sharp outline, being composed of sienitic granite. Bardon Hill, the loftiest, has only a positive height of 853 feet, yet, owing to the great range of surrounding lowland, the view from the summit is grand and imposing in the extreme, and probably embraces a greater sweep of landscape than any other point in the island. In one direction, Lincoln cathedral, distant sixty miles, appears on the horizon; in another, the hills of the Derbyshire Peak; in a third, with a good glass, the Dunstable hills, distant nearly eighty miles, may be distinguished; and, in a fourth, the Malvern hills in Worcestershire, the Wrekin, in Shropshire, and even some eminences in North and South Wales. Right lines described from the extremities of the view would include nearly one-fourth part of England and Wales.

THE MOUNTAIN SYSTEM OF WALES comprises numerous ranges and groups, which have a very close general connexion, and, with high moorland tracts, occupy nearly the whole surface of the Principality.

Snowdonia, the most important chain, stretches in

grand masses, across Caernarvonshire, from the mouth of the Conway river on the north to the shore of Cardigan bay on the south, a direct distance of little more than twenty miles, but nearly double that extent following the zigzag direction of the principal summits. The rocks, enormous in their proportions, with sharp outlines, and disposed in the wildest manner, are for the most part bare, except in hollows filled with peat or clay, where a coarse herbage grows, sustaining a hardy race of sheep and cattle. Snowdon itself, a Saxon name, signifying the "snow-clad hill," forty miles in compass, has three summits, the loftiest of which, called Wyddva, the "conspicuous summit," attains the height of 3,571 feet, and is the most elevated part of the country south of the Grampians. From this point the mountain seems propped by four immense buttresses, separated by as many deep cwms or hollows, three of which have one or more small lakes at the bottom. Fine and stormy weather are necessary to reveal the beauty and sublimity of the panorama. Pennant, in two ascents, witnessed it under both aspects. "I saw," he observes, "the county of Chester, the high hills of Yorkshire, part of the north of England, Scotland, and Ireland; a plain view of the isle of Man and that of Anglesey lay extended like a map beneath us, with every rill visible. I took much pains to see this prospect to advantage; sat up at a farm on the west till about twelve, and walked up the whole way. The night was remarkably fine and starry. Towards morn the stars faded away, and left a short interval of darkness, which was soon dispersed by the dawn of day. The body of the sun appeared most distinct, with the rotundity of the moon, before it was high enough to render its beams too brilliant for

our sight. The sea, which bounded the western part, was gilded by its beams, first in slender streaks, at length glowing with redness. The prospect was disclosed to us like the gradual drawing up of a curtain in an amphitheatre. We saw more and more, till the heat became so powerful as to attract the mists from the various lakes, which in a slight degree obscured the prospect. The shadow of the mountain was flung many miles, and showed its bi-capitated form; the Wyddva making one, Crib y Distill the other. I counted this time between twenty and thirty lakes, either in this country, or Meirionydd (Merionethshire)."

Pennant remarks of his second ascent: "On this day the sky was obscured very soon after I got up. A vast mist enveloped the whole circuit of the mountain. The prospect down was horrible. It gave the idea of a number of abysses, concealed by a thick smoke, furiously circulating around us. Very often a gust of wind formed an opening in the clouds, which gave a fine and distinct vista of lake and valley. Sometimes they opened only in one place; at others in many at once, exhibiting a most strange and perplexing sight of water, fields, rocks, or chasms in fifty different places. They then closed at once, and left us involved in darkness. In a small space they would separate again, and fly in wild eddies round the middle of the mountains, and expose in parts both tops and bases clear to our view." Snowdon has subject-mountains, which rise to a nearly equal elevation.

A second range, the *Berwyns*, extends from the Dee south-west to the mouth of the Dovey. *Cader Idris*, 2,914 feet, towards the western extremity, near Dolgelly, though not the highest summit, is the most remarkable from its crateriform appearance. A great hollow occu-

pied by a stern, dark pool, guarded on three sides by high cliffs, like the crater of an extinct volcano, occurs near the top. Cormorants visit the pool. They seem to be subject to a peculiar economy, two birds only sharing it between them at one time. They come from the Bird Rock, some miles distant, which is thronged with them. The neighbouring lakes and streams seem apportioned to a certain number for their support, and that number is never exceeded; but if one is killed, another is immediately sure to supply its place. Cader Idris, the seat or chair of Idris, has its name from that of a notable but ambiguous personage in Welsh history, who made it his residence. The top, covered with shattered rocks and wholly devoid of vegetation, commands a wide range of land and sea. Northwards, Snowdonia bounds the view. But eastward, the country to the Wrekin in Shropshire is overlooked; westward, the whole curve of the bay of Cardigan appears, dashing its white breakers against the rocky coast from Merioneth to Pembroke, with perhaps a faint line over sea, which is Ireland; southward, Plinlimmon bounds the horizon, with the bay of Swansea and the Bristol Channel peeping through the opening of the Brecon mountains.

Plinlimmon, 2,463 feet, on the borders of Cardigan and Montgomery, is the head of a third range, which stretches through the latter county into Salop. It is remarkable for its huge mass, consisting of three mountains rather than one, piled pyramidally in a gigantic heap. It gives birth to five rivers, the Severn, the Wye, the Rheisdol, the Llyffnant, and the Clevedoc. The summit divides into two heads, each of which is crowned with a *carnedd*; and the Welsh rarely visit the spot without adding one or more stones to the heap.

A *fourth range* is prominent in South Wales, running due east and west, between the Towy and Usk rivers, parts of which are styled the *Black Mountains*, from the dark appearance of the heather, when out of blossom, with which they are clothed. The *Brecknockshire Beacons*, two summits, majestically seen from the town of Brecon, are the loftiest points, 2,862 feet. Minor ridges diverge at various angles from these main ranges, rendering the principality almost entirely a region of ascents and descents; and outlying portions appear in the English border counties. Of these, the *Malvern Hills*, in Worcestershire and Herefordshire, form a definite narrow ridge, running in a nearly straight line from north to south, about ten miles, rising highest towards the centre, in the *Worcester Beacon*, 1,444 feet. They have a much more abrupt slope on the east than on the west, present a rich and beautiful appearance on both sides, and are celebrated for springs reputed to be medicinal, but which are simply distinguished by the extraordinary purity of the water.

The common occurrence of the word "beacon" in relation to our conspicuous heights refers to their use in former times as stations for fire-signals to alarm the country upon the approach of a foreign enemy. Such signals have been common to most nations and are of the highest antiquity, being mentioned by the prophet Jeremiah, who says: "Set up a sign of fire in Beth-haccerem: for evil appeareth out of the north, and great destruction" (vi. 1). Down to the time of Edward III., the beacon fires were made simply of stacks of wood; but in his reign pitch-boxes were substituted. Now the lightning speed of the telegraph has superseded the fires from a hundred hills which roused our forefathers in many a remote hamlet and lonely glen; but they

have only been finally discontinued since the present century commenced.

SCOTLAND, the most truly alpine district of the island, consists of three natural divisions, southern, central, and northern, the two latter of which are the most mountainous parts. The *southern division* extends from the isthmus between the firths of Forth and Clyde to the Cheviot hills on the English border, the scene of many a deadly struggle when they formed part of the line of separation between two politically distinct people. These border heights protrude into Northumberland, where *Cheviot Hill*, properly so called, the most elevated of the range, raises its round-topped summit 2,658 feet. On the other side they connect themselves with the *Lowther Hills*, a kind of highland nucleus in the centre of southern Scotland, from which ridges diverge in various directions, the *Pentland* hills to the neighbourhood of Edinburgh, the *Moorfoot* and *Lammermoor* hills towards the North Sea, and numerous offsets which run out towards the Irish Sea, inclosing the pastoral river-daies for which the district is celebrated. The highest points slightly exceed the elevation of the Cheviots, and overlook a vast extent of country. From the green, flat summit of Hart Fell, near the sources of the Tweed, in fine weather, Skiddaw in Cumberland may be seen on the south, and Ben Lomond on the north, which is more than seventy miles in direct distance. Lead mines at Leadhills in Lanarkshire have called forth life and cultivation in a most bleak and desolate situation, and collected a village at the height of 1,500 feet, the highest inhabited place in Great Britain. A few huts of shepherds and gamekeepers in the Highlands may be at a greater altitude, but they are solitary and not perma-

nently occupied. Near the outcrop of the lead veins the soil contains gold in small grains, which once attracted attention; and through several summers a large number of men were employed in searching for the precious metal. This gold-gathering soon ceased to be a profitable speculation, though fragments of from one to two ounces in weight were sometimes met with.

The *central division* extends from the isthmus before named to Glenmore, or the Great Glen, through which the Caledonian canal has been constructed, connecting the Atlantic Ocean with the North Sea, through the heart of Inverness-shire. This district, containing the main mass of Scotland, is occupied to a very considerable extent with huge and towering mountains. It has an inferior range of trap rocks in the south, extending from near Montrose on the east coast to the town of Dumbarton on the Clyde, distinguished in various parts of its course by the names of the *Sidlaw*, *Ochil*, and *Camphie* hills, which form the southern boundary of Strathmore, or the great valley. North of this valley, the country is traversed in all its breadth, from east to west, by the grand chain of the *Central Grampians*, forming an apparently impassable barrier across the island, nearly a hundred miles in length, with a breadth varying from twelve to twenty-five miles, and an average height of from two to three thousand feet, many summits having a much greater altitude. On the western side, the elevations are prolonged from north to south, reaching to the firth of Clyde, and are conveniently called the *Southern Grampians*. These masses, composed chiefly of crystalline schists, with granite, have a stern and desolate aspect, a broken and serrated outline, and seem solitudes of nature into which man and his labours may not intrude. In fact, it is only by follow-

ing some of the streams which break through the barrier, that admission to its wild recesses can be gained. Naked rocks, or rocks scantily clothed with brown heath and lichens; frowning precipices unsoftened by the hand of time, as if just rifted from equally angular masses; narrow glens where the dark brown streams foam over a craggy bed; broad straths, where the torrent slumbers for a while in some deep black lake; and bleak moors only diversified by moss-grown stones and solitary tarns, with the scarlet crest and bright eye of the moorcock, are the leading features of the scene.

Though the line of perpetual congelation is not reached by the highest summits, it is very closely approached, for they are clothed with snow through the greater portion of the year, and the loftiest peaks retain it in beds and patches all the year round, showing the prevalence of a temperature in those elevated regions seldom much above the freezing point. Dr. Skene Keith, in the middle of July, found the main source of the Dea, near the top of Mount Braeriach, running under an arch of snow. Ben Wyvis has never been known free from snow within the memory of man, except in the remarkably warm season of September, 1826. Sir Hector Munro, of Poulis, the principal proprietor of that mountain, holds his estate in Ross-shire by a singular tenure from one of the early Scottish kings, that of bringing three wainloads of snow from the summit whenever the king shall desire.

Some of the grander and more conspicuous masses may be noticed, beginning with those of the Southern Grampians. *Ben Lomond*, in Stirlingshire, rises with a green conical summit 3,195 feet, on the east side of the lake of the same name, which, with its wooded islands, is a beautiful object in the view from the

acclivities. The mountain is often scaled, being of easy ascent. Tourists have been occasionally greeted at the top with an illusion similar to that of the Spectre of the Brocken, consisting of their own reflected images, pictured upon a cloud of mist opposite the sun, exaggerated to colossal proportions. The giants in the air have of course faithfully imitated every movement of the real personages, gesticulating, walking about, or waving hats and umbrellas. On the north-east side, there is a lofty precipice with a retiring angle, a remarkable feature, but of frequent occurrence in the Highlands. Interest belongs to the conical *Schiehallien*, "female fairy" mountain, in Perthshire, 3,513 feet, as it was selected by Maskelyne, the astronomer royal, and other scientific men, in 1773, for their experiments to determine the attraction of mountains. It stands somewhat isolated, and was chosen on that account for the purpose. After observations conducted through some months on both sides of the mass, it was ascertained beyond dispute, that the mountain exerted a sensible attraction, causing the plumb-line of the instruments to deviate from the perpendicular, leaving no doubt upon the point, that every particle of the earth is endowed with the same property, according to its amount of matter. *Ben Cruachan*, 3,670 feet, in Argyleshire, is remarkable for its vast dimensions, and the complicated intermixture of sea and land overlooked from its summit. Towering on the north of Loch Awe, it is seen to advantage on approaching the lake from the south, apparently dividing it into two branches, from a point which bears the name of Burke's view, as having been praised by the author of the treatise on the "Sublime and Beautiful." *Ben More*, "great mountain," 3,818 feet, an immense irregular pyramid, and *Ben Lawers*, "echoing moun-

tain," 3,945 feet, both in the west of Perthshire, are the loftiest heights.

The moor and lake of *Rannoch*, with the narrow and deep glen in which the Tummel flows, may be regarded as separating the Southern Grampians from the central chain. The moor is an extensive piece of table-land, elevated at least a thousand feet above the sea. It extends about twenty miles in every direction, occupies a space of nearly 400 square miles, and forms one of the dreariest regions in the kingdom. The surface is an immense bog, interspersed with rocky fragments, a lake, and a few pools of black water, largely overgrown with yellow rushes. It feeds no wild animals, is visited by no birds, and has no trees, shrubs, or even heath, except a few firs on the borders of the lake. Yet, though now totally barren, it was once a forest, for the roots and trunks of trees are displayed in almost every ditch and watercourse.

Ben Nevis, "the heaven-kissing hill," as some etymologists translate the name, though standing detached, may be regarded as the western extremity of the Central Grampians. It attains the height of 4,368 feet, and was long popularly supposed to be the highest point of the British isles. Though not entitled to the supremacy in this respect, it has claims to be considered the monarch of our mountains, being only slightly exceeded in altitude, while occupying a situation which admits of its entire outline being exhibited in a single view. The base is on one side almost washed by the tides of Loch Eil, while river-valleys separate it in other directions from all the neighbouring mountains. Shooting up from the level of a moor, its lofty summit has the advantage of directly displaying its whole height. Two hills, geologically distinct, are placed the one upon

the other. The lower hill, nearly 3,000 feet high, is an oblong mass of granite, forming a generally flat plateau, on which lies a mossy tarn, plentifully fed by the mists from the western ocean, the source of a torrent. The upper hill, or true vertex, only occupies the plateau. This is a naked irregular four-sided prism of black or dark grey porphyry, with a zone of the subjacent granite completely surrounding its base. It forms on the north-east a stupendous precipice, cut by numerous narrow vertical fissures partially filled with permanent snow, contrasting singularly with the dark hue of the rock. Imagine a precipitous front, at least 1,500 feet high, bending forwards at many of its parts with a threatening mien, and extending itself to a distance of almost two miles, with enormous projecting masses or abutments, which divide the great re-entering angle of the mountain into a series of vast recesses or aisles of the wildest aspect. Such is the summit of Ben Nevis.

Three magnificent granite mountains, closely united as well as related, near the junction of the three counties of Inverness, Banff, and Aberdeen, form the true nucleus of the grand chain of the Grampians and the most elevated land of the United Kingdom. They rise near the sources of the Dee, west by north of Braemar, and consist of *Ben Aren*, "river-mountain," 3,967 feet, *Cairngorm*, "the blue cairn," 4,095, and *Ben Macdhu*, "black boar mountain," 4,390 feet. Huge tabular masses compose their forms, characterized by naked sterility, the crumbling granite scarcely affording nourishment to a single lichen. The rock in this district seems peculiarly liable to decomposition from the action of the atmosphere. Hence the summits are rounded flats, covered with heaps of fragments, which have resisted

the disintegrating power of the elements, often mixed with finer debris. Similar heaps occupy the adjoining valleys. The group may be regarded as one vast mountain, enclosing and guarding in its bosom the solitary *Loch Aven* with a rugged circle of precipitous heights. This lake, a crystal sheet of water, nearly two miles long, and upwards of 1,700 feet above the sea, is the most elevated expanse of any extent in the kingdom. It is remarkable for its loneliness, difficult access, and frightful steeps, which approach to the wilder and more savage parts of Swiss scenery. The surface, notwithstanding its elevation, has no sunshine for several of the winter months. No tree nor shrub grows on its banks, and few living creatures are ever seen except the eagle and the ptarmigan, or some straggling red deer from the forest of Mar. This spot, scarcely surpassed anywhere in stern, secluded grandeur, was selected by the Ettrick Shepherd, in one of his poems, as the scene in which the Spirit of the Storm is roused.

The NORTHERN DIVISION of Scotland extends from the preceding region to the Pentland firth, and has a surface more extensively mountainous, and more generally elevated, though not reaching to the same height, the productive lowlands being chiefly confined to bays and firths of the east coast. It is seldom visited by summer tourists, who have usually had enough of clambering after having scaled the Grampians; but it comprises scenery and objects of interest which will amply reward the lover of nature, though there are vast tracts of bleak and unattractive moorlands. The higher masses are *Ben Clibbrick*, "mountain of the skirmish," 3,165 feet, in Sutherlandshire; *Ben More*, "great mountain," 3,231, in the same county; *Ben Dearg*,

"red mountain," 3,551, in Ross-shire; *Ben Wyvis*, "mountain of horror or terror," 3,720, partly in Ross and Cromarty; and *Ben Attow*, "thatch or rush mountain," 4,000 feet, on the borders of Ross and Inverness. On the west coast, in the neighbourhood of Loch Assynt, a far extended ocean-like waste of rocks, interspersed with lofty conical piles of gneiss, is thus described by Macculloch, in his own peculiar style: "Round about there are four mountains which seem as if they had tumbled down from the clouds, having nothing to do with the country, or each other, either in shape, materials, position, or character, and which look very much as if they were wondering how they got there. Which of them all is most rocky and sterile is probably known to the sheep; human organs distinguish little but stone, black precipices when the storm and rain are drifting by, and when the sun shines, cold, bright summits that seem to rival the snow. *Suil Veinn* loses no part of its strangely incongruous character on a near approach. It remains as lofty, as independent, and as much like a sugar-loaf (really, not metaphorically) when at its foot as when far off at sea—the total altitude from the sea-line is probably 2,500 feet, the table-land whence this and most of the other mountains of this coast rise appearing to have an extreme elevation of 1,500 feet. To almost all but the shepherds, *Suil Veinn* is inaccessible."

IRELAND has its general physiognomy determined by a great central plain, with imposing highlands on its borders, occasionally throwing out spurs into it. They form no continuous belt, so as to encircle the low central country, cutting it off entirely from the shores, but occur in detached groups of limited extent, short ranges, or

without any regular distribution. On the east coast, the mountains of Mourne in Down approach the elevation of 3,000 feet, and those of Wicklow slightly exceed it; but, with these exceptions, the great heights and the conspicuously rugged districts are on the western side of the island. They frequently press closely to the shore, descend abruptly to the water's edge, and form coast scenery of the most magnificent description. This is particularly the case in Donegal, where stupendous cliffs directly front the Atlantic, and have no parallel as to altitude in any other part of the United Kingdom. The *Twelve Pins* in Galway, *Mount Brandon* in Kerry, and other lofty masses occupy specially maritime sites, and are seen far out upon the western deep. The latter county has the most decidedly mountainous surface, and contains the highest summit of Ireland. This distinction belongs to *Carn*, or *Gurranee Tuail*, one of the Macgillicuddy's Reeks, which rises 3,404 feet. The Reeks, a ridge extending due east and west between the lakes of Killarney and the ocean, are so called from their sharp, jagged peaks, the appellation of Macgillicuddy being derived, according to tradition, from an old family in the neighbourhood. The highest peak is *cone-shaped*, and has a smooth summit, about thirty feet in diameter, with a uniform slope on every side. The view from it, whenever the vast volumes of clouds and mists which roll from the Atlantic and rest upon the mountains are withdrawn from them, is most extensive and very striking, owing to the many long, narrow peninsulas and estuaries it commands. The Reeks on one side, and Tomies mountain on the other, inclose the Gap of Dunlop, a pass remarkable for its wild and savage scenery.

VALES, VALLEYS, AND PLAINS.

That form of the surface which is defined by the term VALE is a tract of land between rising grounds, generally traversed by a river, and expanding in the direction of its current. ENGLAND contains the most numerous and important examples, of which the *vale of York* is the largest. It extends about sixty miles from north to south, by an average breadth of sixteen miles, and includes an area of 1,000 square miles. It is for the most part fertile, and on it are the towns of Northallerton, Thirsk, Boroughbridge, York, and Selby, in the centre, with many others on the eastern and western margins. Next in point of extent is the *vale of the Severn*,

" Nature's garden wide,
By the blue steeps of distant Malvern wall'd."

This is a tract of the richest soil, through which the river sweeps with great boldness, divided by some hills into upper and lower, or the *vales of Gloucester and Berkeley*. The latter is a fine region of grass land lining the estuary, which has a very noble appearance at high tide, and forms an eminently beautiful scene, with the beech woods on the slopes of the bounding hills. The *vales of Exeter, Taunton, Aylesbury, Evesham, and Belvoir*, are similar tracts of great fertility, producing the finest crops and luxuriant herbage. WALES has corresponding districts in the *vales of Conway, Mold, Clwyd, and Llangollen*, but more picturesque in style, owing to the mountainous character of the principality. *Strathmore*, or the great valley, in SCOTLAND, between the Grampians on the north, and the Sidlaw, Ochil, and Campsie hills on the south, is the greatest continuous

tract of low country in that part of the kingdom, but it has not the loamy soil which usually characterizes vale land, and some parts are waste and uncultivated.

The vale form of the surface becomes a VALLEY by contraction, diminutives of which are known as dales, dells, and glens. In an open country they have rounded and gently swelling embankments; but in highland districts, lofty and steep walls of rock often form the sides, which variously approach and recede. They are commonly water-courses, and take the name of the streams flowing through them, as Tees-dale, Tyne-dale, Dove-dale, Esk-dale, and Teviot-dale. Some of the more open kind inclose tracts of rich alluvial soil; others have pasture for hardy sheep on the mountain sides; while many, deep and narrow, approaching to the character of chasms and defiles, are remarkable for wild beauty or gloomy grandeur. The examples are too numerous to be particularized; but some distinct peculiarities of aspect may be noticed. Valleys of denudation, or those apparently formed in soft and practicable strata by the action of water, are of constant occurrence, and are subject to frequent changes from floods transporting the old soil to a lower level, or introducing a new deposit from a higher, and altering the channels of the streams. But besides these, which have placid features, there are glens connected with running water, which seem as if fashioned in their present state, while more deeply scooped, by its sudden rush in an overpowering volume through them. Such is the aspect of the interesting Valley of Rocks in the neighbourhood of Linton in North Devon. It appears walled in by loose, unequal masses piled upon each other, sometimes forming rude natural columns, or arranged fantastically along the summits of the heights

so as to resemble extensive ruins overhanging the rugged hollow. Huge fragments are scattered over the bottom, and interrupt the flow of the stream. The appearance of the valley is suggestive of a vast and violent torrent having swept through it in a westerly direction, tearing up the rocks from their beds, and hurling them along, as it rushed through the broad gaps which still open upon the British Channel.

Valleys of undulation, lying between two neighbouring elevations, produced by their lifting up, without occasioning fracture or dislocation of the strata, are common features of the surface in the moderately hilly districts, and are very definite in the chalk downs. Valleys of dislocation, caused by fissures of various dimensions, some of colossal size, appear in connexion with the high lands, and are well represented by the extraordinary gap in the Mendip Hills at Cheddar, and by the Dove-dale of the Peak. They seem as if formed by some convulsion of nature, which rent asunder what had before been a compact mass, for the opposite sides present salient and re-entering points so corresponding to each other, that, if it were possible to bring them together, but little trace would be left of their former separation. Dovedale extends about three miles in length between high and precipitous limestone rocks, which closely approximate in some places, and then retreat. Projections from these walls form sharp pinnacles and bold bluffs. The beautifully clear river pursues its winding way at their base, now still, now murmuring, and anon dashing over the blocks and stones that have fallen from the heights into its bed. Wild flowers common to the limestone—copses of hazel and mountain ash—with picturesque rocks and limpid water, combine to form a scene that satisfies at first sight, and increases in interest

the more it is examined. This valley, at its western extremity, is entered through a narrower dale, the inhabitants of which, a few cottagers, never see the sun in winter unless they go out of it; and, when his beams begin to reach them in spring, it is not till about one o'clock in the day, which is called the Narrowdale noon, and is used as a proverb when anything is delayed.

PLAINS, geographically understood, are not perfectly horizontal surfaces; the term denotes a greater or less extent of country, flat in its general level as compared with that of a hilly region. North Cumberland, great part of Cheshire, and the north of Salop, have this character. *Salisbury Plain*, in Wilts, a woodless, oval-shaped district of chalk formation, covered with a fine green sward, is actually traversed by numerous and sometimes extensive valleys, and has almost everywhere an uneven billowy surface. Seen from a distance it seems a dead level, and is comparatively so around the stupendous relics of Stonehenge. The *Weald of Kent*, *Surrey*, and *Sussex*, between the North and South Downs, is an extensive plain, with gentle eminences diversifying the surface, which are lost to the view when the country is overlooked from the adjoining hills. But the greatest extent of flat land in the kingdom lies on the north of the Thames, and stretches through the eastern counties into Yorkshire, comprehending the remarkable region around the estuary of the Wash, or the district which is specially styled the Fens.

Soil which is almost constantly soaked with water, and commonly of a vegetable texture, constitutes a fen, a marsh, a bog, or a moss; for these are so many different names for the same superficial feature, the modifications of which are very slight. Such tracts occur in maritime

and inland situations, on elevated moors and the slopes of mountains, but are most frequently met with in lowland plains. Central Somersetshire has very extensive marshes, now brought under cultivation to a considerable extent by draining, but historically famous in their natural state, for the refuge they afforded to Alfred the Great in the Isle of Athelney. Romney Marsh, at the south-east angle of Kent, has been similarly reclaimed, but by embankment from the sea, which once washed over it at high tide. But the characteristic example is the Great Level of the Fens, comprising portions of the counties of Lincoln, Norfolk, Cambridge, Huntingdon, and Northampton. It extends about fifty miles from north to south by from twenty to thirty in the opposite direction, and includes an area of not less than 500,000 acres. The greater part belongs to Lincolnshire, consisting of the whole of that division of the county appropriately called Holland, *hollow* or low land, which resembles in its general features the continental country of that name. The large amount of water brought down by the rivers of the Wash, their very slight fall, and the lowness of the district, expose it to floods from heavy rains, and to inundations of the sea, requiring a net-work of artificial channels, with hydraulic machinery to promote drainage, and keep the waters in check. Immense tracts of level land, intersected with straight lines of drains, of dimensions little less than those of considerable rivers, and bounded with high green turfbanks; no hedges, but countless ditches in their place, the course of which is marked with long waving lines of sedge; few trees, the pollard-willow being the most common, with some rushy, unreclaimed places and swampy osier-beds; scattered homesteads, thinly sprinkled villages, and a far-off horizon, are characteristic of

the landscape. Though ordinarily unattractive, the stranger finds excitement in the wide range which the eye commands from a very slightly elevated mound, while on bright summer days the aspect of the country is most glorious, apparently an unbroken and unbounded sea of deep green pasture or golden wheat.

The foundation of the fen-land is a bed of muddy sand, or silt, at a varying depth below the surface, which abounds with sea shells, and exhibits ripple-marks in places, the evidence of tidal action. Above this, there generally lies a layer of bluish calcareous clay, of considerable thickness, containing fresh-water shells. The surface consists of a dark brown or completely black crumbly crust of peat, a compound of decayed vegetable matter and earthy sediment, in some places nine or ten feet deep, and in others not so many inches. The peat has numerous trunks of trees embedded in it, with the remains of forest animals, the wild boar, wild cattle, the red deer, elk, and beaver, once existing in the district; and fragments of the canoes and weapons of the ancient Britons have been exhumed from it. While the trunks of the trees are in the peat, the roots are generally found firmly planted in the underlying clay. No chronicle has recorded when the forest fell and the peat was formed; but the latter event rapidly follows the former, as current events have shown. Probably both occurred in the pre-historic period, or before the arrival of the Romans. It seems undoubted that, in their time, extensive tracts were overflowed by the sea at spring tides, for they restrained its incursions by embankments, while confining the rivers by the same means, and constructing drains to carry off the land waters. The "Roman bank," as it is called, is a long line of defence against the sea, passing near Wainfleet, Boston,

Spalding, Wisbeach, and other places, well known as Roman stations. Thus a habitable and cultivable area was gained, which subsequently became the site of large monastic establishments, and was renowned for its fertility. But embankments and drains being afterwards neglected, the sea occasionally broke through, and the land water accumulated, till districts once cultivated presented an unhealthy surface of stagnant pools and spongy earth, nearly useless to man. The recovery of the country from this state dates from the early part of the reign of Charles I., since which time an almost uninterrupted series of drainage works have been in progress at an enormous cost, forming altogether one of the most stupendous enterprises of modern times.

Level tracts in SCOTLAND are of unimportant extent ; but the main part of the surface of IRELAND, particularly the central region, is a vast limestone plain. It stretches across the island from Dublin to Galway Bay, and from the county of Fermanagh on the north to the confines of Waterford on the south. Though this great tract has hills and valleys, the most elevated point, Moat-a-grenogue, in Westmeath, is little more than 300 feet above the sea. It consists partly of rich cultivated land ; but a large proportion of the area is occupied with bogs, principally lying west of the Shannon, in the counties of Roscommon, Mayo, and Galway. These characteristic formations are composed of decayed vegetable matter or peat, covered with unproductive living vegetation, holding more or less stagnant water. A shallow pool seems originally to have induced and favoured the vegetation of aquatic plants, which gradually crept in from the borders towards the deeper centre. Mud accumulated around their roots and stalks, till a

spongy fluid mass was formed, well fitted for the growth of moss, which began to luxuriate. Absorbing a large quantity of water, the moss, of which *Sphagnum palustre* is the principal species, continued to shoot out new plants above, while the old were decaying, rotting, and compressing into peat below. In this manner the bogs seem to have been formed, many of which are daily and hourly adding to their area, and increasing their depth, by the growth of living, and the accumulation of dead plants. They are estimated to cover one-tenth of the surface of the island, while the peat has an average thickness of twenty-five feet, though sometimes extending to nearly twice that depth.

Peat-bogs, called mosses in Scotland and the north of England, have sometimes a treacherous character, presenting a dry and apparently firm crust in dry seasons, but yielding and quivering to the tread, being semi-fluid below. Gilpin states of the Solway Moss, a flat area, about seven miles in circuit, that the adventurous passenger who passes this perilous waste to save a few miles, pushes his cautious way over the rushy tussocks as they appear before him, for here the soil is firmest; but if his foot slip, or if he venture to desert this mark of security, it is possible he may never more be heard of. At the battle of Solway, in the reign of Henry VIII., when the Scotch army, commanded by Oliver Sinclair, was routed, an unfortunate troop of horse, driven by their fears, plunged into this morass, which instantly closed upon them. The tale was long traditional, but it has been authenticated, a man and horse in complete armour having been found by peat-diggers in the place where it was always supposed the affair had happened. The skeleton of each was in remarkably good preservation owing to the well-known antiseptic properties of

peat. Though restricting agriculture, and deleterious to health, while called the "ulcers of the earth" from their appearance, bogs, fens, marshes, and swamps are not without their uses. In foreign countries, they supply aquatic game in abundance for consumption and commerce, with eels, myriads of leeches, and bog iron-ore, which is worked with advantage, as in Siberia. At home, reeds, rushes, and willows, which flourish in such sites, are of considerable local importance; bog-earth, or the soil near the surface, forms an excellent manure for certain lands, and is extensively employed in modern agriculture; and peat, dried by the heat of summer, is in many districts the principal or the only fuel. It has been observed, that the rainy climate of Ireland and the wet occupations of the people, with the nature of their food, render a fire more necessary to them than to most others. Hence, as there is a very marked deficiency of timber, while coal is there beyond the reach of the poor, the bogs have been to them invaluable, supplying inexhaustible stores of fuel and a highly prized comfort upon easy terms.

The face of terrestrial nature has been wisely moulded by the hand of the Almighty for the performance of high functions and the accomplishment of benign results. Those apparently accidental irregularities of the surface which we every day behold are not unmeaning peculiarities of structure, but are absolutely essential to the existence of organized beings, while they minister in a thousand ways to the convenience of man, and are sources of pleasure to him in their contemplation. If the land were to become of an unvarying level, the valleys filled up and the hills brought low, beauty, fertility, and habitableness would

depart from the earth ; and the curse would be fastened upon the entire globe which was denounced against a particular locality :—" It shall never be inhabited, neither shall it be dwelt in from generation to generation ; neither shall the shepherds make their fold there." * As under such an arrangement there could be no natural drainage, the circulation of moisture, so vitally important and so constantly maintained, would be completely arrested. Instead of the surplus of the rain which comes down from heaven to water the earth flowing off in rills, brooks, and rivers to the ocean, it would rest upon a perfect level, saturate the whole surface of the ground, render cultivation impossible, and produce a vast marsh, sending forth noxious exhalations, and being only habitable by reptiles and the lower forms of life. The existence of dry land, fit for the occupation of man, the higher animals, and the growth of general vegetation, depends upon the distribution of the surface into uplands, slopes, and lowlands. "The Lord by wisdom hath founded the earth ; by understanding hath he established the heavens." †

Diversities in the surface of the earth are referred to in holy writ as important natural advantages. Thus the description of Judea—a region in which highlands, valleys, and plains intermingle—though not intended to be philosophic, is in harmony with the teaching of science respecting the influence of elevated lands in the production of atmospheric phenomena. In contrast with Egypt, a flat country, almost without rain, and watered by a stream flowing from far distant mountains, it is stated :—"The land, whither thou goest in to possess it, is not as the land of Egypt from whence ye came out ; —but a land of hills and valleys, and drinketh water of

* Isaiah xiii. 20. † Proverbs iii. 19.

the rain of heaven.”* Mountains and hills arrest the passage of the clouds, while their cold summits act as huge natural condensers, forcing the atmosphere to part with its moisture. Hence the abundant precipitation common to highlands, by which the streams and rivers of the lowlands are primarily formed and constantly fed. Mountains are also the principal repositories of the metals, which would not have been so accessible to man if differently distributed. Moreover “the high hills are a refuge for the wild goats; and the rocks for the conies;”† and often have liberty and religion found safety in their strongholds from the power of the tyrant and the persecutor.

The varied features of the landscape are not more calculated than they are doubtless intended to inspire the mind of the spectator with admiration and pleasure. Mountains have a grandeur and valleys a loveliness which but few even of the dullest of rational beings can contemplate without impression and emotion. But to minds enlarged and refined by education, and led in quest of knowledge to communion with nature, the ample display of magnificence and beauty in the external world appeals yet more strongly. Still the visible creation is alone truly enjoyed by the man who is at peace with its Author: whose heart has been regenerated by the Spirit of grace, and who is reconciled to God by faith in Jesus Christ. While susceptible of the pleasures derived from imposing or graceful objects, he receives a satisfaction from them peculiar to himself and others like-minded. To him they bear witness of God, his Father and his Friend, who, though invisible, is manifested by “the things that are made,” and is actively present wherever there is motion, breath, or

* Deuteronomy xi. 10, 11. † Psalm civ. 18.

being. He regards the visible as a mirror reflecting the power and perfections of Deity, yet as a veil of glory which he has cast around the thick darkness in which he dwells to mortal sight; and delightedly anticipates the period when "we shall be like him; for we shall see him as he is."* Such an individual

" Superior walks
Amidst the glad creation, musing praise
And looking lively gratitude."

* 1 John iii. 2.

CHAPTER VI.

THE INLAND WATERS.

Water—Character of Springs—Mineral Waters—Warm Springs—Incrusting Waters—Value of Springs—The Rivers—Table of the Principal—The Humber, Trent, and Ouse—Their Estuary—The Severn—The Thames—Its Source—Islets of the River—Its Changed Aspect—Depositions—Mersey, Dee, and Ouse—The Wear on Fire—The Tay—Tweed and Clyde—Minor Scottish Rivers—The Shannon—Minor Irish Rivers—Meeting of Waters—Subterranean Streams—Waterfalls—The Lakes—English, Scottish, and Irish—Arrangements of Nature

WATER, which is essential to the existence of man and animals, the fertility of the soil, and a thousand comforts and arts of life, appears at the surface of the land in the three leading forms of springs, streams, and lakes, each of which has numerous modifications. Springs may be intermittent, depending for their supply upon recent rains; or permanent, the outlets of great subterranean reservoirs. Streams may be mere brooks brawling over a pebbly bed, or rivers meandering grandly through verdant fields, ploughed by ships and steamers through extensive portions of their course. Lakes may be the expansions of streams, caused by their discharge into some great hollow, from which they escape at the opposite extremity; or completely land-locked basins, depending upon showers and subaqueous springs, forming mountain tarns and lowland pools. In all these forms, with their endless diversities of aspect, water is a most ornamental feature of nature—a thing of beauty—while most wonderful in its properties and

adaptations. What more marvellous than that the same substance should occur under such diverse conditions—afloat as vapour in the atmosphere, solidified and silvery in snow, hard and glassy in ice—while as a fluid it calmly sleeps or gently flows, not breaking the reed in its bed, yet foams and plunges in the torrent, thunders in the cataract, and rolls with overpowering might and impressive majesty in the ocean?

The rains and melted snows are largely absorbed by the soil, or percolate downwards through crannies and fissures, till, arrested by impervious strata, the water accumulates, and is forced by hydrostatic pressure to find its way again to the surface, oozing out from the sides and at the bottom of the hills. In level tracts of country where springs literally rise, or reach the surface by ascension, the supply is derived from distant elevations, having travelled laterally through intermediate pervious strata, and being at length discharged upon the same principle. Many springs flow copiously, then feebly, altogether fail, and renew their tide at irregular intervals. They depend entirely upon the prevailing character of the season, whether rainy or dry. Valleys in the chalk downs of the south of England are well watered during one part of the year, and are dry in another. A Wiltshire proverb recognises the alternation—"As the days lengthen, the springs strengthen." Perennial or constant springs, sometimes discharging a great volume of water, and showing little diminution in the longest drought, are obviously quite independent of the last showers, though primarily derived from rain and melted snow, which originate bodies of water in

subterranean reservoirs, so vast as not to be exhausted before they are replenished. St. Winifred's Well, in Flintshire, is estimated to discharge twenty-one tons of water a minute, and has never been known to fail, though subject to reduction in long-continued dry weather. In rare instances, wells exhibit tidal phenomena, ebbing and flowing with somewhat of a character of periodicity, and having a definite high and low watermark. This alternation has not been satisfactorily explained. Laywell, near Torbay, and Weeding Well, in the Peak, are examples of the peculiarity.

In its natural state, water is more or less impregnated with foreign ingredients, either derived from the atmosphere or the soil, or from decomposed or living animal and vegetable substances. But some springs, in percolating through the strata, take up mineral substances and gases so largely as to acquire a decidedly mineralized character, producing a sensible effect upon the animal economy, and being occasionally of great sanatory value. Our mineral waters may be grouped into three classes, the *saline*, the *chalybeate*, and the *sulphureous*, several of which annually attract thousands of visitors in search of health, and have crowded naturally rugged and desolate sites with fashionable buildings; while some, from the romantic beauty of the scenery around them, attract those who need the refreshment of change of place.

The *saline* springs are variously impregnated with different salts, sulphates, and carbonates of lime, magnesia, and soda, and the chlorides of calcium, magnesium, and sodium. Examples occur in England at Epsom, Cheltenham, Bath, Bristol, Buxton, Matlock, and Leamington; in Scotland, at Dunblane and Airthrey,

near Stirling, Pitcaithly near Perth, and Innerleithen near Peebles; and in Ireland, at Mallow in the county of Cork. Springs simply yielding chloride of sodium, or common salt, are found in the rock-salt region of Cheshire, at Droitwich in Worcestershire, near Ashby-de-la-Zouch in Leicestershire, Shirleywich in Staffordshire, Builth in Brecknock, and Kingswood near Bristol. The *chalybeate* waters are specially characterized by the presence of iron, which is most frequently held in solution by free carbonic acid. The examples are very numerous; in England, at Tunbridge, Cheltenham, Harrowgate, Brighton, and other places; in Scotland, at Hartfell near Moffat, Vicar's Bridge near Dollar, and Bonnington near Edinburgh; and in Ireland, at Castle Connell near Limerick. The *sulphureous* waters, containing sulphuretted hydrogen, are, in England, chiefly at Harrowgate, Cheltenham, and Leamington; in Scotland, at Strathpeffer near Dingwall and Moffat in Dumfriesshire; and in Ireland, at Swanlingbar in Cavan and Lucan in Dublin.

Some of the foregoing are *thermal* or *warm springs*, all of which have a closely corresponding geological position, rising through strata of the carboniferous system, or through others which rest unconformably upon them, and remarkably exhibit the prevalence of nitrogen among the gases evolved. Their localities and characteristics are as follows:

Bath.—Hot Bath, temperature 117° , King's Bath 114° , Cross Bath 109° . The King's Bath spring rises through lias, at a temperature of 66° above that of the neighbourhood. It contains saline ingredients, muriate of lime and magnesia, 15 grains in a pint; and evolves 96.5 per cent. nitrogen, 3.5 oxygen, and some carbonic acid. The city owes its origin and importance to these

springs. Though known by different names at different epochs, it has always had an appellation derived from them. The Romans called it *Aquæ Solis*, and erected baths upon a magnificent scale, some traces of which have been discovered, indicating the luxurious habits of the people. The Saxons named it *Bathun*, and also *Achamunnum*, or city of the sick.

Bristol.—The Hot Well rises in carboniferous limestone at a temperature of 25° above that of the place. It contains sulphate of soda and muriate of lime, 6 grains in a pint; and evolves 92 per cent. nitrogen, and 8 oxygen.

Buxton, Derbyshire.—St. Anne's Well rises in carboniferous limestone at a temperature of 33° above the vicinity. It contains a small proportion of the muriates of magnesia and soda, and evolves nitrogen only. The spring sends forth sixty gallons of water a minute, clear, colourless, without taste or smell, and never varies in temperature at any hour of the day or season of the year. It has been long in repute, for Roman baths have been discovered, and was visited occasionally by the unfortunate Mary Queen of Scots, who spent many years of her imprisonment in England in the neighbourhood. Some lines, scratched on one of the windows of the apartment she occupied in the old hall, are still shown as her composition :

*Buxtona, quæ calidæ celebrare nomine lymphæ,
Forte mihi posthac non adeunda, vale.*

*Buxton, farewell ! no more perhaps my feet
Thy famous tepid streams shall ever greet.*

Bakewell, Derbyshire.—The Bath spring rises in carboniferous limestone, at a temperature of 13° above the vicinity, containing sulphate of lime and muriate of

soda, $3\frac{1}{2}$ grains in a pint; and evolving nitrogen only. It is mentioned by Camden, and is supposed to have been known to the Romans.

Stony Middleton, Derbyshire.—The spring rises in carboniferous limestone, at a temperature of 14° above that of the vicinity, and contains sulphate of soda and magnesia, and muriate of lime, 2 grains in a pint, evolving nitrogen only.

Matlock, Derbyshire.—Three springs rise in the same strata, little more than tepid, with properties resembling those of the Bristol waters. These tepid springs are from fifty to a hundred feet above the level of the river Derwent, while cold waters issue from the strata above and below this range. The close juxtaposition of warm and cold springs is of common occurrence, and apparently anomalous; but obviously, though close to one another at the surface, they must have wholly distinct subterranean sources and routes. St. Anne's Well at Buxton is within twelve inches of a cold spring. The Matlock waters were not much known before the close of the seventeenth century, as the grand valley in which they are situated was scarcely practicable, till the rocks had been removed by blasting, which at various points approached near to the margin of the river. "This bath," says Defoe, "would be much more frequented than it is, if a sad, stony, mountainous road which leads to it, and no accommodation when you get there, did not hinder." The glen has long been traversed by one of the best turnpike roads in the kingdom, and has now its railway.

Taafe's Well, near Cardiff.—Rises from coal strata, at a temperature of 21° above that of the place; and contains a minute quantity of sulphate of magnesia, evolving $96\frac{1}{2}$ per cent. of nitrogen, and $3\frac{1}{2}$ of oxygen.

Mallow, County of Cork.—The Spa well rises in carboniferous limestone, at a temperature of 23° above that of the vicinity; and contains a very small proportion of carbonate of lime, evolving $93\frac{1}{2}$ per cent. of nitrogen, and $6\frac{1}{2}$ of oxygen.

No thermal waters occur in Scotland, nor are they known in England further north than the Derbyshire Peak. Their temperature has been referred to chemical action, and to contact with the generally heated interior of the earth. The latter cause seems the most probable, as they have no peculiar chemical quality distinct from cold springs; and from observations made in mines, it is undoubted, that the internal temperature of the earth increases with the distance from the surface. In this case, they must percolate through cracks and fissures to a great depth, and be very highly heated, in order to be returned to the surface before they are cooled down.

In many instances, *chalybeate* springs hold in solution so large a quantity of iron, that their basins, with the channels of the rills flowing from them, are encased with a ferruginous deposit, while the mosses and grasses in contact with the water are deprived of their natural green, and covered with a yellow incrustation. But of all mineral ingredients in springs, calcareous earth, or lime, combined with carbonic acid, occurs in the greatest abundance, and is deposited most largely. These are the *petrifying* wells and waters of popular speech, so called from the objects exposed to their influence being supposed to be turned into stone. But incrustations are not petrifications. The leaves, stems, and branches of trees, bones and shells, with the bird's nests and wigs which illustrate the bad taste of the guardians of such springs in Derbyshire, are simply

invested with a calcareous coating or crust, sometimes porous and friable, but often crystalline and compact. These bodies are not permeated by the stony matter, but inclosed; and they are either found upon the outer mass being removed, or the cavities remain left by their decay. The Dropping Well, at Knaresborough, on the banks of the Nidd, which trickles from its source over the surface of a rock, and falls from its edge in a number of little streams, with a pleasant tinkling sound, is highly charged with a gritty or sparry matter, and incrusts with it the grass, leaves, shrubs, and twigs of trees in contact with the water. At Matlock, the thermal springs abundantly deposit lime, and have formed thick beds of rock of so firm a texture as to be used for building. Objects exposed to them are said to be completely enveloped with a thick mass of beautiful white stone in less than twelve months, and are sold as curiosities.

Whether bursting from rocky clefts, rising through arid sands, or oozing out of grassy banks, springs are inviting objects; and, wholly, independent of natural beauty and utility, they powerfully appeal to the reflective mind, as invested with interesting historical associations, the emblems of purity and benevolence, and the consecrated types of that Divine grace which refreshes and purifies the souls of all believers. Though not inhabiting a dry and thirsty land, like ancient Israel when in the wilderness, we can sympathize with the feeling that led the people, with their princes, nobles, and lawgiver, to "sing this song, Spring up, O well; sing ye unto it."* In the dark ages, a kind of idolatrous veneration was paid to wells, in different parts of the kingdom, on account of the copiousness and permanence of their flow,

* Numbers xxi. 17.

or the medicinal virtue of their waters ; and it was deemed of religious value to go on pilgrimage to them, for the purpose of drinking of their streams. While the superstition has happily passed away, it is natural and Christian to take high interest in the fountains of water, as finely illustrating the care and bounty of Providence, in opening places of refreshment by the wayside for man and beast, while undergoing fatigue and enduring heat. And what Christian can sit down by the spring, weary and faint with journeying, and parched with thirst, without gratitude for the gift, and thankful recollections of Him, who with all power at his command, all happiness within his reach, and all agencies at his disposal, was in similar circumstances, and underwent the like suffering for the benefit of our fallen race ?

“ At Jacob’s well a stranger sought
His drooping frame to cheer ;
Samaria’s daughter little thought
That Jacob’s God was there.”

The brook, the rivulet, and the river, are three forms of flowing water which differ chiefly in magnitude and utility. Issuing commonly from some spring, the brook becomes a rivulet by junction with another brook ; the rivulet swells into a small river, by a similar mode of increase ; and such rivers, for the most part, join a grand trunk, or principal river, which pours its volume into the sea. This main channel, with all the minor ones, to the remotest rill and spring, constitutes a river-system. The surface of the country is plentifully supplied with these water-courses, owing to abundant rains, mists, and numerous springs ; and they furnish the means of an extensive inland navigation, having only in general a fall

of a few hundred feet in a course sometimes of from one to two hundred miles, the distance between the source and the mouth. Camden, in his *Britannica*, states, that there are in England and Wales alone five hundred and fifty rivers and rivulets, distinguished by particular names. But, attending only to river-systems, the number of any national or commercial consequence, in the whole of the United Kingdom, is thirty-four. Of these nineteen belong to England and Wales, seven to Scotland, and eight to Ireland. Estimated by the area of their basin, or the extent of country drained by them, they rank as follows :

	Area of Basin.	Length.
	Square Miles.	Miles.
Humber, including Trent and Ouse	9,550	171
Severn, including Wye, Usk, and Avon	8,580	239
Shannon	6,946	224
Thames, including Medway	6,160	220
Barrow, including Nore and Suir	3,410	114
Great Ouse	2,960	150
Bann	2,345	100
Tay	2,250	130
Tweed	1,870	96
Mersey	1,748	70
Clyde	1,580	96
Avon (Wiltshire)	1,210	70
Spey	1,190	96
Yare	1,180	60
Blackwater	1,165	100
Nen	1,132	100
Tyne	1,100	80
Foyle	1,100	80
Witham	1,050	70
Boyne	1,002	70
Eden	995	72
Dee (Wales)	862	80
Tees	744	80
Slaney	734	70
Ribble	720	60
Welland	708	60
Dee (Aberdeenshire)	705	87
Parret	653	45
Forth	645	60
Eke	643	55
Tamar	603	55
Lee	595	60
Don	530	50
Towy	506	70

It is somewhat unfortunate, as apt to create confusion, that the same name is sometimes given to several different rivers. Thus there are three Derwents, three Dees, three Rothers, four Ouses, five Esks, and nine Avons.

The HUMBER, including the Trent and Ouse, is the largest of our rivers, as to the magnitude of its basin, which is very nearly equal to one-sixth of the total area of England and Wales. This *comprises* almost the whole of Yorkshire, with the counties of Leicester, Nottingham, Rutland, Derby, and Stafford, about one-third of Lincoln, part of Warwick, and small portions of Worcestershire and Lancashire, thus embracing some of our most fertile and populous districts. The *Trent*, the longest and most important branch, rises in the moorlands of north Stafford, and is formed by the junction of several streams in an extensive pool near Kimpersley Hall. Before leaving the county, it expands into a noble pond of eighty acres in Trentham park, the seat of the Duke of Sutherland. The river remarkably changes its direction, running at first from north to south, then inclining to the east, and, gradually becoming north-easterly, it finally flows from south to north towards its termination. Among its principal affluents are the *Tame* from Tamworth, the *Dove* from Ashbourne, the *Derwent* from Derby, and the *Soar* from Leicester. The Trent is navigable by vessels of considerable burden as far as Gainsborough; and by barges as far as Burton, a distance of about 120 miles. Tidal water ascends seven or eight miles beyond the former town, where there is the lowest bridge on the river. The *Ouse* branch has its remotest source at Swale-head on the mountain of Shunnor Fell, near the borders of Yorkshire and Westmoreland. It is formed by the

junction of the *Swale* and *Ure* at *Boroughbridge*, and receives the *Nidd* from *Knaresborough*, the *Wharfe* from *Tadcaster*, the *Aire* from *Leeds*, the *Derwent* from *Malton*, and the *Don* from *Sheffield*. The tide ascends the river to a lock about four miles below *York*.

The mass of water brought down by the two rivers takes the name of the *Humber* at their junction off *Faxfleet*, and follows a winding course of forty miles to the *North Sea* at *Spurn Point*. The upper part of the estuary has an average breadth of two miles, but expands to five at high water in the lower, becoming considerably contracted by the projection at its termination. Its shores are everywhere low, composed chiefly of clay, silt, and gravel,—alluvial deposits which extend many miles inland. Although much encumbered with shoals and sandbanks, there is a main channel available for ships of the largest size up to *Hull*. Above that point, the depth is less; and the shoals often shift so rapidly as to render careful navigation necessary. It not unfrequently happens that steamers going up by one channel have to return on the following day by another, owing to changes in the bed of the river, while sounding poles are used on both sides to ascertain the depth as they proceed. Immense quantities of sediment are brought in from the sea at flood-tide, derived from the waste of the *Yorkshire coast*, which are deposited at high water, when the river is in a quiescent state, and have originated new land. *Sunk Island*, below *Hull*, in the reign of *Charles I.*, was really an island, containing only seven acres, upwards of a mile from the shore, with an intervening channel through which large ships could pass. It is now scarcely distinguishable from the main land, has a circuit of $3\frac{1}{2}$ miles, and contains about 7,800 acres, covered with a green carpet of grass, which have been

gradually formed by the deposits of the river, and been permanently reclaimed by the industry of man.

The SEVERN—*Hafren* of the ancient Britons, and *Sabrina* of the Romans—ranking second in the area of its basin, pursues a very curvilinear course, on which account it is the longest of our rivers, the distance along the channel being about twice the direct distance from source to mouth. It issues from a chalybeate spring on the east side of huge Plinlimmon, and proceeds north-east to Shrewsbury, then bends to the south-east, and flows southerly by Worcester and Gloucester to the Bristol Channel, which was formerly called the Severn Sea. Its principal affluents are the *Warwickshire Avon* from Stratford, the *Wiltshire Avon* from Bristol, the *Wye* from Monmouth, and the *Urk* from Newport. In ancient divisions of the country, this river formed a boundary between the territory of the Silures and Ordovices on the east, and the Deborini on the west; but in the subsequent arrangement of counties it has scarcely anywhere been employed as a line of separation. No lock or weir marks the whole course of the river. The tide ascends to Gloucester, and light craft go up to Coalbrookdale, in Salop. Salmon, now a scarce fish in this river, was formerly so abundant there, that a clause was commonly inserted in the indentures of the apprentices at Worcester, that they should not be fed upon it oftener than twice a week. No river in Europe is charged with so large an amount of sediment, owing to its own course, and that of its tributaries, being for considerable distances through tracts of marl and soft sandstone.

The THAMES, though only the fourth in point of magnitude, ranks the first as a tidal river, and is com-

mercially the most important stream on the face of the globe. Its rise is popularly referred to *Thames-Head*, a spring a few miles to the north of Malmesbury, in Wiltshire. But if the origin of rivers is determined by the rills that are most remote from their mouths, and that contribute the greatest quantity of water, the honour of giving birth to Old Father Thames belongs to the oolitic beds on the south-eastern slope of the Cotswold hills in Gloucestershire. At the distance of about three miles south of Cheltenham two brooks rise, the principal one from several openings at a spot called the *Seven Springs*. They are not distinct fountains, but evidently connected with each other—separate discharges of the same spring. The spot is a sequestered romantic dell, overhung with a canopy of luxuriant foliage, at the foot of Leckhampton Hill, often visited as one of the “lions” of the neighbourhood. This is unquestionably the true Thames-Head. “Here,” says the guide, a sturdy peasant woman, “be the springs from which comes the great river Thames, which is called Isis till it gets past Oxford. Here they be, seven of ’em, one, two, three, etc. And they never run less in the driest summer, and never are frozen in winter. How thankful ought us to be for such a plenty of good water!” It gushes copiously out of the rock, clear and pure as crystal, deliciously cool and grateful to the summer Rambler. After a few whirls, it starts upon its course, as if impatient to reach the objects in its path, seats of learning, haunts of the muses, royal palaces and castles, old baronial halls, and the great world of London, bearing its shipping to the sea. In about a mile, the brook from Seven Springs is joined by another from Ullen Farm; and the small river *Churn* is formed by their junction. It flows to Cricklade, a distance of about twenty miles, where the *Isis* or

Thames from Wiltshire is met, which has only performed a journey of about ten miles, and has an inferior volume of water.

Through nearly the whole of its course, the *Thames* is a border river, separating Gloucestershire from Wiltshire, Oxford and Buckinghamshire from Berks, Middlesex from Surrey, and Essex from Kent. The principal affluents are “the *Kennet* swift, for silver eels renowned,” which falls into it at Reading; the *Wey*, received near Oatlands; the *Lea*, entering in the neighbourhood of the East India Docks; and the *Darent*, below Dartford. The *Medway*, included in the basin of the river, and its most important branch, falls into the estuary at Sheerness.

The upper and middle portions of the *Thames* are remarkable for the little islands, locally called *aits*, which occur singly and in clusters, and are as varied and beautiful as they are numerous. “Not many of them are of any great size, and only two or three have dwellings upon them; excepting such as are used for locks, when it is not uncommon for the lock-keeper’s house to be built on the ait; but several have toy-houses—taking the form or name of temple, grotto, or summer-house, according to the taste of the proprietor. Some of them are planted with groups of good-sized trees, such as ash and beeches, and others that will thrive in damp soils; but the alder and willow are the most common, and perhaps are most suitable for the situation. The smaller aits are generally planted with osiers. As these aits occur in the shallows, they are frequently surrounded by beds of rushes; while the willow-herb and the tall loosestrife, and similar flowers that love such places, grow in marvellous profusion around them, so that they are often encompassed by a belt of brilliant colours. Those that

are used as pleasure grounds by private possessors have generally their banks made up, and set about with piles and wattles—greatly to the injury of their beauty. The natural boundaries are always pleasing in form, always take the easy, pliant, varying line that most harmonizes with the opposite banks of the river. It is always thus in nature. The smallest bit of broken bank that Nature is left to mould and dress soon becomes an object that is graceful—that must be admired if a man will stoop to examine it.” These islands are the homes of the water-hen and the swan, both of which are eminently Thames birds.

The river maintains an equable and moderate current. Its natural character is correctly described by Denham in the much admired couplet :

“Though deep, yet clear ; though gentle, yet not dull ;
Strong without rage ; without o’erflowing full.”

The breadth in the lower part of its course is as follows : at London Bridge, at high water, 290 yards ; at Woolwich, 490 ; at Gravesend pier, 800 ; at Coal House Point, three miles below Gravesend, 1290 yards ; and at the Nore six miles, expanding to eighteen miles lower down. As a navigable river, the Thames has peculiar advantages, owing to its depth of water, the far advance of the tide, and no mud-bar at its mouth. The tide-water extends to Teddington (Tydington), nineteen miles above London Bridge, and sixty-four miles from the Nore. Vessels of any burden ascend to Deptford ; those of 1400 tons reach Blackwall ; and those of 800 tons get up to St. Katherine’s Docks near the Tower. There is no other example in the world, with perhaps the exception of the Amazon, of a river being navigable for large sea-going vessels through so considerable a part of its course.

In the early times of our history, the natural aspect of the Thames below London, and for some distance above it, was widely different to what it is at present. Where smooth pastures now form the banks, with grazing cattle, busy towns, and villages, enlivening the landscape, the stream once spread without restraint, covering the surface with shallow and stagnant waters, as if a firth or estuary, with perhaps no definite channel of any depth. Geological researches and historical notices corroborate this view, with the name, according to Ptolemy—*Tamessæ Estuarium*. The appellation of the "Pool," still given to the river immediately below bridge, is significant, alluding to its former lake-like appearance, for in the ancient language of England pool was lake. As commerce demanded a readily navigable water-way to the city, embankments were formed to restrain the vagrant flood, extending to the distance of nearly forty miles. They were executed at the cost of the citizens, under the early Plantagenets. The effect of these embankments has been to deepen the bed as well as contract the width, for by confining the stream and tidal current its velocity and scouring force has been increased.

The Thames deposits a considerable quantity of earthy matter in its channel, some of which undergoes a singular transportation. Nearly 3000 vessels are employed in bringing coals to the metropolis from the northern coal-fields. Upon discharging their cargoes, the ships get back to Newcastle and the other ports for fresh ones as quickly as possible; and, as they cannot obtain goods from London sufficient to freight them, they take in ballast to enable them to sail in safety. This ballast is chiefly gravel and sand dredged up from the bottom of the Thames in and near Woolwich-reach. The Trinity

House takes upon itself the duty of supplying it. There is a Ballast Office to which the masters of collier vessels apply for the required amount when about to sail; and it is sent in lighters, so much per ton being paid for it. About eighty tons on an average are required for each vessel; and about 10,000 tons per week are thus disposed of. Upon reaching the Tyne or the Wear, the ballast becomes of no farther use; and as it must not of course be thrown overboard into the rivers, it may be seen on many an adjoining site, lying in huge heaps from 200 to 300 feet high, forming miniature ranges of hills. Thus literally does the bed of the Thames go to form the banks of the Tyne; and the soil of the southern counties is transported to the northern. Probably the river carries sufficient earthy matter to form a bar at its mouth, interfering with navigation; but, no obstacle occurring to slacken the speed of the current, the sediment is carried farther from the coast, and deposited in deep water.

Among the remaining English rivers, the MERSEY ranks after the Thames as a commercial roadway, flowing through the cotton manufacturing district. It rises on the confines of Derbyshire, receives the *Irwell* from Manchester, and the *Bollen* from Macclesfield, meets the tide at Warrington, and gives its name to the inlet of the sea between Cheshire and Lancashire, which has the great emporium of Liverpool on its northern shore. The neighbouring DEE, the largest of the Welsh rivers, after travelling from Bala Lake, through the beautiful valley of Llangollen, and passing Chester, terminates in an estuary which remarkably changes its character, becoming a noble arm of the sea at high water and dwindling to insignificance at the ebb. On the opposite

side of the country, the Buckinghamshire OUSE pursues a long course to the *Wash*, through an entirely agricultural district, without splash or murmur, creeping rather than flowing. Cowper's few touches—"Ouse's silent tide"—its "flags and reeds"—its

"Slow winding through a level plain
Of spacious meads with cattle sprinkled o'er,"

describe all its characteristics. The TYNE, WEAR, and TEES, coal-shipping rivers in the lower part of their course, are connected with some of the finest scenery in the kingdom in the upper, flowing and dashing through dales of the mountain limestone. Interrupted in its passage by a ridge of basaltic rocks,

"The madden'd *Tees* with maniac fury foams."

The *Wear*, a few years ago, exhibited a singular spectacle, as seen from Framwell-gate Bridge in the city of Durham. Its surface, while unruffled by the wind, was observed to be in a state of ebullition, occasioned by numerous streams of air bubbles issuing from below. After being viewed for a time with mere curiosity, an unusual agitation of the water induced a particular examination. The suspicion soon arose, that the jets of air must flow from some fissures under the bed of the river, and would prove to be an escape of the light carburetted hydrogen gas generated in such fearful abundance in the coal and other strata of the district. A boat having been moored alongside the principal jet, its inflammable nature was fully ascertained by the application of a lighted taper. By means of inverted funnels furnished with pipes of the requisite length, fixed over the supposed fissures, the gas was collected at the surface and ignited, producing large and brilliant flames.

The strange spectacle lasted till the supply was exhausted; and thousands congregated to see the Wear apparently on fire.

The TAY, the finest salmon river in the kingdom, is the monarch of Scottish streams, and also of British ones, if regard be had only to the amount of water brought down to the sea. It discharges in a mean state, according to a careful measurement by Dr. Anderson, 218,159 cubic feet of water per minute, which exceeds the volume conveyed by the Thames. It rises in the mountainous country to the north of Loch Lomond, expands into the beautiful long narrow lake called Loch Tay, flows with a rapid current by a circuitous route to Perth, and passes from thence through an estuary into the North Sea below Dundee. In the basin of this river, there is an epitome of everything connected with the action of running water, the erosion of rocks, the transport of soil, and the changes of lakes and valleys.

Next in rank are the TWEED and the CLYDE, which offer an example of streams having closely contiguous sources flowing off to opposite seas. Both descend from the highland centre of southern Scotland. The Tweed, pure and limpid, famous in border history, travels eastward to the North Sea, which it enters at Berwick; while the Clyde, celebrated for its falls, after some branches have run at first also towards the east, flows to the north-west by Glasgow, and joins the Atlantic through one of the great indentations of the western coast. It is a singular circumstance, that salmon and their fry have occasionally been taken in the upper parts of the Clyde, above its loftiest fall; and, this being eighty feet in height, it seems utterly impos-

sible for fish of any kind to surmount it. The fact is accounted for in this way. After passing Tinto Hill, the bed of the Clyde approaches to a level with that of the Biggar Water, which is close at hand, and discharges itself into the Tweed. On the occasion of a great flood, the two streams become connected, and thus the salmon of the Tweed find their way into the Clyde.

The other considerable Scottish streams are the FORTH, the SPEY, and the ABERDEENSHIRE DEE. The *Forth* descends from the eastern slopes of Ben Lomond, and flows through low alluvial plains by Stirling to the magnificent firth on which Edinburgh is situated. The *Spey* has its origin within a few miles of the west coast, but proceeds to an opposite shore, passing through Badenoch and Strathspey, the best wooded portion of the Highlands, and falling into the sea below Fochabers. In the upper parts of its course it slumbers in dark mossy lakes; in the lower, it rushes on with headlong speed; and is decidedly the wildest, most capricious, and rapid of British rivers. The *Dee* issues from a spring on Mount Braeriach, one of the Grampians, at the height of 4,060 feet above the sea, which it enters at Aberdeen. This is the highest spring in the United Kingdom, and the greatest fall of any of its streams. Ben Nevis has a spring at the height of 3,602 feet, and another on Ben Audler reaches the height of 3,650 feet.

The SHANNON, in Ireland, the third river of the kingdom in the extent of its basin, is the first in the length of its navigation. It rises from the base of the Culleagh mountain, in the north-west of Cavan, in a limestone cavern, from which it issues through a circular gulf,

about fifty feet in diameter, and at once assumes the character of a considerable stream. It flows generally from north to south, passes through Loughs Allen, Rea, and Derg, descends to Limerick, and having met the tide, it travels westerly through a long and noble estuary to the Atlantic. This river is of vast importance to the island, as it stretches through its centre, washes the shores of ten counties, and nearly insulates the great province of Connaught. It is navigable to the distance of 214 miles from its mouth, or through nearly the whole of its course; while the navigation of the Severn extends only 192 miles, and that of the Thames 193 miles from their mouths. A peculiarity belongs to it which is very rarely observed in rivers. In general, their fall is the greatest towards their sources, and decreases proportionably towards their estuaries; but the case of the Shannon is an exception to this rule, its fall being greater in the lower than in the upper part of its course. From the head of Lough Allen to the foot of Lough Derg, a distance of 131 miles, it descends at the rate of little more than four inches per mile. But between the last named point and Limerick, the inclination of its bed changes considerably, and gradually increases, till it reaches a fall of seventeen feet per mile, between the towns of Castle Connel and Castle Troy. It is here that the great stream, 300 yards wide, and forty feet deep, pours its body of water through and above a congregation of huge rocks and stones, extending nearly half a mile, and forms the magnificent rapids of Doonas, where the navigation is conducted by a lateral artificial canal. Inglis, a wanderer in many lands, had never heard of these rapids before he arrived in the neighbourhood; but ranks them in grandeur and effect above either the waterfalls of Wales, or the Giessbach in Switzerland.

Next to the Shannon is the **BARROW**, including the *Nore* and *Suir*, which are popularly called the Three Sisters, from rising in the same range of mountains, and after a long separate course pouring their united waters through Waterford harbour into the Atlantic. Then follow the **BANN**, divided into upper and lower by Lough Neagh, entering the sea below Coleraine; the **BLACKWATER**, discharging itself into Youghal Bay, one of whose affluents has been immortalized by Spenser, who resided by its current; the **FOYLE**, which passes by Londonderry into the large inlet of the sea called Lough Foyle; the **BOYNE**, famous for the ever-memorable battle fought by its waters between the forces under William III. and James II., the largest river of the east coast; the **SLANEY**, debouching in Wexford haven; the **LEE**, the estuary of which is the well-known harbour of Cork; "the pleasant **BANDON**, crowned with many a wood," falling into Kinsale harbour, now shorn of much of the fine timber it possessed when the author of the "Faery Queen" trod its banks; and the **LIFFEY**, on which Dublin is situated. The confluence of streams, often an imposing and always an interesting physical incident, is nowhere in the British isles displayed under circumstances of greater attraction than in the county of Wicklow. The first "Meeting of the Waters," where the **AVONMORE** and **AVONBEG** unite and form the **OVOCA**, is a scene of great natural beauty, inclosed by high grounds covered with fine natural woods, which command magnificent views of granitic mountains. From the confluence, the river flows through a lovely valley, between high banks adorned with an unbroken range of forest, to its union with the **AUGHRIM**, a stream descending through a glen from the base of Lugnaguilla, the highest

of the Wicklow mountains, constituting the second "Meeting of the Waters."

A few examples occur of rivers disappearing in parts of their course, and re-emerging after a subterranean flow. Milton, in one of his juvenile poems, speaks of the

"Sullen *Mole*, that runneth underneath."

and Pope calls it, after him, the

"Sullen *Mole*, that hides his diving flood."

But this is the language of poetical exaggeration. The stream, one in Surrey, has no underground course. It is simply in various places absorbed in dry summers, and lost in the porous bed through which it runs, leaving stagnant pools alternating with tracts of naked gravel. But the ALYN, an affluent of the Welsh Dee, after breaking through the Flintshire hills, passes along a subterraneous channel for nearly a mile, and then enters the plain of Cheshire. The MELT, in Glamorganshire, rolls through the dark hollow called Cwm Porth, while cattle graze and harvests wave upon the incumbent rock. This is a great natural tunnel, about four hundred yards long, forty feet wide, and twenty high at the entrance, and which is finely shaded with forest trees. On a bright day there is sufficient light for examining it for about fifty yards, when it gradually fades away into impenetrable gloom. The HAMPS and the MANIFOLD likewise, two small streams in Derbyshire, are absorbed by the rocky fissures in their channels in dry summer weather, and re-appear after travelling underground for several miles.

Few of the rivers have important WATERFALLS; but

mountain torrents precipitated into dark glens are fine and common features of the scenery in Wales, the north of England, the highlands of Scotland, and Ireland, often compensating for want of volume by the force and depth of their descent. One of the most striking examples of a river-fall is exhibited by the *Tees*, above Barnard Castle, provincially called *High* or *Mickle Force*. Surrounded with steeps clad with wood, and divided into two branches by a single rock, the river, already a considerable one, dashes down a perpendicular precipice of 70 feet, with a roar that is audible for miles, and with a spray which the sunshine adorns with the rainbow. The *Clyde*, a little above Lanark, has three principal falls in the space of three miles, *Bonnington Linn*, 30 feet; *Corra Linn*, 84 feet; and *Stonebyres*, 80 feet; making, with some minor descents, a total of 230 feet. But, after heavy rains, the *Falls of Foyle*, near Loch Ness, afford the grandest exhibition of the kind in the kingdom, the upper fall being a descent of 70 feet, and the lower a single leap of 212 feet. The highest waterfalls are formed by mountain streams in Ireland. At Powerscourt, in Wicklow, the *Dargle* descends 300 feet; while at Hungra hill, in Cork, the *Adrigole* precipitates itself at least 700 feet. But in both instances the supply of water is often small.

Some shallow and spacious pools occur in the eastern lowlands of England, provincially called meres, and were formerly much more numerous, many having been drained that their beds might become corn fields or grass lands. Small sheets of water are plentifully

sprinkled over the mountains of Wales, remarkable in general for their pitchy blackness, arising, perhaps, from the peaty impregnations which discolour most of the streams. *Bala Pool*, the largest, is an exception to this aspect. Being beautifully transparent, its water strikingly contrasts with that of the tan-coloured *Dee*, which runs through it, and forms a distinct dingy streak upon the surface. But lakes, properly so called, are restricted, south of the *Tweed*, to the *Cumbrian* mountains, where they occupy glens or hollows between them, and, though of no important extent, are in the highest degree attractive. Rock, water, island, wood, lawn, villa, and ruin, with the tops of giant heights in the distance, form the finest combinations. *Windermere*, the most considerable, nearly eleven miles long, by from one to two broad, contains thirteen islands, and has a depth in places of 200 feet. *Ullswater*, *Conistown-water*, *Derwentwater*, and *Bassenthwaite-water*, are the next in extent. *Derwentwater* is remarkable for its floating island and Bottom-wind. The island, near the south-eastern corner, is only an occasional apparition, consisting of a portion of the peaty bed of the lake, which rises to the surface. It is probable that the mass is swollen and buoyed up by gases produced by the decomposition of the vegetable matter; for, upon being pierced, carburetted hydrogen and azote issue in abundance. The Bottom-wind, also occasional, is an escape of subaqueous air-currents, causing ebullition at the surface of the water.

Lacustrine waters eminently distinguish both Scotland and Ireland, but differ remarkably in their features. The Scotch lakes, or lochs, as they are called, are long, narrow, and confined, closely pressed upon by high lands; while the Irish loughs have their length

and breadth more proportionate, are for the most part in open districts, and have a considerable extent of level strand or marshy border. *Loch Lomond*, the largest purely British example, between the counties of Dumbarton and Stirling, has a length of twenty-four miles by a breadth of seven, where the greatest expansion occurs, but is contracted to one mile towards the north extremity. It is surrounded with high mountains and studded with islands, about thirty in number, ten of which are of some considerable extent, finely clothed with wood. The other large lakes, *Awe*, *Ness*, *Shin*, *Maree*, *Tay*, *Arkeig*, *Sheil*, and *Lochy*, have the same general conformation, but the mountains are much sterner, and the shores are often bare of vegetation. *Loch Ness*, in the track of the Caledonian canal, is remarkable for its great depth, upwards of eight hundred feet. It is never frozen in the severest seasons. *Loch Leven*, a beautiful expanse in Kinross-shire, is the only lake of any extent which does not belong to the Highlands.

Ireland contains the largest lake of the United Kingdom in *Lough Neagh*, which washes the shores of five counties in the province of Ulster, extends twenty miles by twelve, and is celebrated for the encrusting quality of its waters. *Lough Corrib*, in Connaught, much smaller, but the next in magnitude, has the peculiarity of maintaining communication with *Lough Mask*, about three miles to the north, by a subterranean channel through the intervening limestone isthmus. The stream in its caverned bed is visible at several places through openings in the surface, one of which, called the Pigeon's Hole, sixty feet deep, may be descended. The lakes of *Killarney*, among the mountains of Kerry, three in number, mutually connected, are renowned for the contrasts afforded by their scenery, from the soft,

verdant, and beautiful, to the wild, rugged, and sublime. *Lough Derg*, in Donegal, bounded by dreary moorland hills, and subject to violent gusts of wind, contains on one of its islands St. Patrick's Purgatory, a site annually visited by thousands of votaries.

There is nothing more admirable in the arrangements of nature than the mode by which the springs, rivers, and lakes are maintained, and that supply of humidity is imparted to the soil upon which its fertility depends, and its adaptation to the support of animal and vegetable life. By a process of evaporation, marvellously subtle and powerful, in which heat is the prime agent, the "waters fail from the sea," and are also largely exhaled from the streams and moist earth. Vast masses are raised into the atmosphere in the state of invisible vapour, which, being condensed by cold, re-appear in the form of clouds, and are precipitated, by further condensation, in showers of rain or snow. Philosophically true is the language of the prophet: He "calletli for the waters of the sea, and poureth them out upon the face of the earth."* Thus the fluid which the atmosphere takes up from the surface is returned to it again; and that portion which is not re-evaporated from the land, or absorbed by organic life, is restored by the mechanism of rills and streams to its native oceanic bed, ready to undergo a similar circulation. "All the rivers run into the sea; yet the sea is not full," because of incessant evaporation; "unto the place from whence the rivers come, thither they return again."†

" Rivers from the ocean borne
Lave the valley and the hill,
Prison'd in the fountain mourn,
Murmur in the winding rill.

* Amos v. 8; ix. 6.

† Ecclesiastes i. 7.

Still wherever doom'd to stray,
Still they warble and complain;
Still pursue their devious way,
Till they reach their native main.

After many a year of woe,
Many a long, long wandering past,
Where at first they learn'd to flow,
There they hope to rest at last."

The tendency of water to find its way back to its original source, after fertilizing the soil, and refreshing animated nature, is admonitory and instructive respecting the right direction and the proper end of human life. Received from the Divine Being, and designed for a useful service, it should be sacredly consecrated to the high purposes for which it was bestowed, the promotion of the honour of God and the welfare of our fellow creatures. Then, when the pilgrimage of threescore years and ten in the realms of mortality has been accomplished, while the body goes to the dust as it was, the immortal soul, redeemed by the death of Christ and sanctified by the Holy Spirit, will return to God who gave it, to enjoy the blessedness of abiding for ever in the bosom of Infinite love, encompassed by the arms of Almighty power.

CHAPTER VII.

THE CLIMATE.

Mild and Equable Temperature—Its Causes—Influence of the Ocean—Effect of the Gulf-stream—Details of Temperature—Unst and Penzance—Gosport and Exeter—Leadhills—Highest Summer Temperature—Coldest District—Fickleness of the Climate—Prevalent Winds—Storm Winds—Their Rotary Character—Storm of 1703—Recent Rotary Gales—Helm Wind of Cumberland—Humidity of the Climate—Details of the Rain-Fall—Annual Number of Rainy Days—Modification of the Climate—Register of Severe Winters—General Inference.

THE CLIMATE of the British Isles is remarkable for its mild and equable temperature, as compared with that of continental districts under the same parallels of latitude, whether European, Asiatic, or Transatlantic. The annual mean temperature, or the average of heat and cold throughout the year, is from ten to twenty, and even, in some instances, twenty-five degrees of the thermometer higher with us than at several continental sites, though the latitudes closely correspond and the elevations above the sea are not materially different. In the east of North America, at a distance from the equator the same as that of the vale of York, the soil is perpetually frozen at a certain depth, and only thaws at the surface in summer; and in Asia this occurs in a latitude corresponding to that of the basin of the Thames. But, besides a greater annual amount of warmth, the relative temperatures of the seasons respectively do not differ so widely as in continental regions. Moscow has a hotter summer than London, with a winter nearly thirty degrees colder; and, while

at Quebec, in the one season, grapes sometimes ripen in the open air, in the other it is no uncommon occurrence for mercury to freeze. In North Germany, Sweden, European and Asiatic Russia, Labrador, and Canada, after a high summer temperature, the inland seas are ice-bound through the winter months, the lakes and rivers are firmly frozen, the snow lies deep and hard upon the ground, and travelling is performed in sledges; while our seas are ever open, firm ice rarely clothes the larger streams, and the severities of cold are inferior in degree, of very rare occurrence, and lasting but a short time. The difference between the temperature of the hottest and coldest months in Great Britain is about 24° . It becomes greater in proportion as we advance further into the continent; the difference being, 34° at Hamburg, 38° at Berlin, and 57° at Moscow and St. Petersburg; and this difference increases in the interior of Asia, following the same latitude.

The comparatively mild and even temperature under the meridian of Greenwich, which is extended to the north-western coast of Europe, or the shores of Norway, has engaged the attention of physical inquirers, and its causes are very plain. While the distribution of heat over the surface of the globe is subject to a general law of reduction as the latitude of places increases, or as we pass from equatorial to polar regions, this law is vastly modified by the physical structure of countries, whether highland or lowland, and by their relation to the sea, whether far from its waves or near them. The position of Great Britain and Ireland being not merely maritime, but surrounded on all sides by expanded waters, mainly determines the climate of the kingdom, both in relation to warmth and humidity.

The ocean, not being so rapidly heated and cooled as the land, does not pass from such extremes of heat and cold as the latter, but preserves a far more uniform temperature, lower in summer and higher in winter than what is experienced in inland districts. This character is imparted to the atmosphere in contact with the surface of the sea, and is transferred by the winds to the shores within their range. Hence insular and maritime climates are more moderate and equable than the continental; the cooler currents of air from the ocean tempering their summer heat, and warmer currents mitigating their winter cold. The immense evaporation from the sea, producing a frequently overcast sky along the shores, contributes also to the same effect; the clouds lessening the solar influence in summer, and checking radiation of heat from the land in winter. The summers of London are cooler than those of Paris, owing to the contiguous sea, while the winters are milder from the same cause, though the latitude is more northerly; and the same is true of the seasons of Ireland, relatively to those of Great Britain, that island being more fully exposed to the moderating and equalizing power of the expanse of the ocean.

While the zone of water around us operates to prevent violently contrasted seasons, the mean annual temperature is higher than in equal latitudes on the continent. This arises from the Gulf-stream and the predominating winds, which blow from equatorial regions, and partially bear along with them the heat of the tropics. The powerful and celebrated current referred to is an outflow of heated water from the caldron of the Gulf of Mexico, whence the name is derived. After rushing through the Strait of Florida, and proceeding along the coast of the United States in a narrow

volume, it turns eastward, and sweeps across the whole of the Atlantic, gradually expanding in breadth, slackening in speed, and diminishing in temperature. Its influence extends to the shores of Ireland, Scotland, and Norway, to which every year seeds and fruits are transported from the hot regions of the West Indies and Central America. This great sea-stream not only raises the temperature of our islands by the south-west winds being in contact with its current, but it shields us from the ice-fields and ice-bergs which annually descend from polar latitudes into the Atlantic, and melt away in the warm water. It has no perceptible climatic effect upon the opposite coasts of the United States, because there the prevailing breezes carry the hot circumambient air away from the shores. Our archipelago would experience a temperature at least 20° colder if the great hollow of the North Atlantic were to be filled up with dry land, since the south-west winds, under such a condition, would sweep across a continent instead of travelling over the surface of the Gulf-stream.

Details of temperature in relation to some particular places, proceeding from south to north, are as follows :

	Hottest Months	Coldest Months.	Difference.	An. Mean
	Mean Temp.	Mean Temp.		
Penzance . . .	62.1	42.6	19.5	51.8
London . . .	62.4	37.2	25.2	49.7
Dublin . . .	61.5	39.3	22.2	50.1
Manchester . . .	60.8	38.7	22.1	48.8
York . . .	60.5	38.4	22.1	49.2
Whitehaven . . .	60.6	38.5	22.1	49.1
Edinburgh . . .	58.7	37.1	21.6	47.1
Aberdeen . . .	60.5	37.8	22.7	49.2
Straness . . .	55.4	38.0	17.4	46.3
Unst . . .	54.5	37.0	17.5	44.7

Thus, the mean temperature of the year at Unst in the Shetlands, the extreme north of Great Britain, is

about 7° lower than at Penzance, in the extreme south, mainly due to difference of latitude. Local causes sometimes considerably vary the temperature between places in very nearly the same latitude, and with no difference as to elevation above the sea. On the south coast, Gosport is warmer than Exeter, because the south-west winds reach it direct from the sea; while, on their passage to the latter place, they are cooled by the high granitic plateau of Dartmoor. At no great height on our hills and mountains a change of climate is perceptible in the decrease of warmth, as the effect of elevation. Observations at Leadhills, in Scotland, 1,280 feet above the sea, where the mean annual temperature is about 41° , give a decrease of 1° for 366 feet of ascent. Hence it follows that, at the elevation of about 5,000 feet, an aeronaut would there reach the line of constant congelation or perpetual snow; and this line, having, of course, a lower altitude further north, is closely approached by the culminating points of the Scottish mountains.

In general, July is our hottest month and January the coldest, while the mean temperature of April and October closely corresponds to the annual mean. The highest summer temperature, amounting to 64° , occurs in the central portion of the south coast of England, including the county of Dorset, part of Devon, Somerset, Wilts, and Hants, with the Isle of Wight. From thence to a line which traverses the extreme south of Wales and crosses England diagonally by Birmingham and Lincoln to the east coast, the summer temperature ranges from 64° to 62° . All Ireland, nearly the whole of Wales, the north of England, and Scotland up to the Highlands, have a summer warmth of from 62° to 60° . The lowest temperature of the season, 54° , marks the

north-west part of Scotland, or the westerly portions of Inverness, Ross, and Sutherland, where wheat ceases to be cultivable. The coldest portion of the kingdom is a section of the east coast, extending from Norfolk to the Firth of Forth, and including all the country inland to the Pennine chain. From thence westward, the temperature of the coldest month increases and attains its maximum on the west coast of Ireland, where the mildest winters occur, and ice and frost are scarcely known at the sea-level. The more moderate character of the winters, as we proceed from east to west, is obviously the effect of the greater influence of the westerly winds and proximity to the Gulf-stream.

The winds are very variable in our latitude, and produce, by shifting their direction, that inconstancy of temperature, with other changes of the weather, for which the climate has unjustly acquired an inglorious distinction. The atmospheric changes, though sudden and frequent, have a limited range, not involving so great a rise or fall of the thermometer as is common to most other countries. Whatever may be the resulting inconvenience of fickle weather, it is fully equalled by the disadvantages of foreign climates. Thus, in Southern Europe chilling blasts descend with violence from the snow-crowned Alps, and alternate with the breath of the sirocco from the deserts of Africa, so heated and oppressive as to render the slightest exertion a burden, and exposure to it a misery. Charles II., according to Sir William Temple, formed a correct estimate of the climate of his kingdom, and he was no stranger to continental experiences. "I must needs," says Temple, "add one thing more in favour of our climate which I heard the king say, and I thought new and right, and truly like a king of England, that loved

and esteemed his own country. It was in reply to some of the company who were reviling our climate, and extolling those of Italy and Spain, or at least of France. He said he thought that was the best climate where he could be abroad in the air with pleasure, or at least without trouble and inconvenience, the most days in the year and the most hours of the day; and this he thought he could be in England more than any other country in Europe." With all our atmospheric changes from bright to cloudy, clear to foggy, fair to wet, there is no part of the globe where the inhabitants enjoy in general a greater measure of health, exhibit more bodily and mental activity, or furnish so many examples of longevity.

The north, north-east, and east winds are cold; those between south and west are warm; and those between west and north are of a mixed character. Westerly winds, including the north-west, west, and south-west, are far more prevalent than the easterly, taking that term with the same latitude. The number of days during which both classes have been observed in a year in different parts of Great Britain has been thus registered:—

Years of Observation.		Westerly.	Easterly.
10	London	233	132
7	Lancaster	216	149
51	Liverpool	190	175
9	Dumfries	227.5	137.5
10	Branxholm, Northumberland	232	155
7	Cambuslang	214	151
8	Hawkhall, near Edinburgh	229.5	155.5
	Mean.	220.3	141.7

Not only are westerly winds the most prevalent, but

their mean direction is from the south-west. Winds from this quarter blow more frequently than any other during every month of the year, but are most common at London in June, July, August, November, and December. Designating the total number of winds that blow in a given time by 1,000, their relative frequency in England is as follows:—s.w. 225, w. 171, n.w. 120, n. 82, n.e. 111, e. 99, s.e. 81, s. 111.

The same point of the compass from which we have the most genial breezes, the south-west, is also the quarter from which tempests most frequently proceed. Storm-winds of great violence, fatal to life and property on the coasts, are annual occurrences; but sometimes, though happily not often, they visit our islands with such tremendous fury as to be more than ordinarily destructive, extending desolation to the land, as well as ravaging on the deep. These hurricanes have their rise on the opposite side of the Atlantic, in its equatorial districts, or in the heart of the American continent, and travel from south-west to north-east, sweeping over the British isles, on their passage to polar latitudes. It seems a well-ascertained fact, that besides having a progressive rectilinear motion, they have a rotary movement, and are truly might whirlwinds, the air at the outer circle revolving with immense velocity from right to left, while gusts and lulls occur in the vortices, the diameter of which may extend several hundred miles. Hence the direction of the wind at a particular point furnishes no clue to the course in which the whole revolving mass of the atmosphere is advancing, though this is known from independent circumstances to be as stated, or from the equator obliquely towards the north pole in the northern hemisphere, and towards the south pole in the southern. It is singular that, while to the

north of the equator the storm-wind whirls from right to left—the direction opposite to that of the hands of a watch—the reverse is the case on the south of the line.

The “Great Storm” of 1703, as it is called in our annals, is the most awful event of the kind of which we have authentic records. “Nov. 26,” says Dr. Isaac Watts, in some memoranda, “Friday night and Saturday morning, the great and dreadful storm.” It originated in the far interior of America, reached the east coast of the continent, swept across the Atlantic gathering force and fury on its course, passed over the southern half of England and the north of France, crossed Holland, Germany, Sweden, and Russia, into northern Asia, till it was lost in the polar ocean, thus accomplishing three parts at least of the circuit of the globe. Thursday, the day preceding the tempest, there were light showers in the morning, with the wind high in the afternoon, lightning in the evening, and short, violent squalls at night, with heavy rain. The next day the wind was south-south-west, and continued high till eleven o’clock at night, when it blew with inconceivable violence till towards noon on Saturday, and carried ruin with it from the Trent to the Loire. Upwards of 800 houses, 400 windmills, and 250,000 timber trees were thrown down; the lead on the churches was rolled up like a parchment scroll, while numbers were wholly unroofed; 300 sail were lost upon the coast; 900 barges and wherries were destroyed on the Thames; 15,000 sheep, besides cattle, perished by the overflowing of the Severn; and property was lost to the amount of four millions sterling. Eight thousand seamen were drowned; and more than a hundred persons were killed on land by the fall of buildings. Among the latter

was the bishop of Bath and Wells, with his wife, upon whom part of the episcopal palace fell. The first Eddystone lighthouse was swept away; and, by a singular coincidence, Winstanley, the architect—who had boasted of its stability, and expressed the wish to be in it when it blew a storm—was that night an inmate, and perished with the fabric. Queen Anne appointed a national fast on account of this fearful visitation, stating in her proclamation, that “we most humbly acknowledge it to be a token of the Divine displeasure, and that it was of the infinite mercy of God that we and our people were not thereby wholly destroyed.”

Revolving storms of great violence visited our shores December 5, 1822; December 3, 1823; and November 29, 1836. The latter originated on the east coast of America, reached Europe in the latitude of the English channel, and was finally lost in Lithuania. It passed over London at ten o'clock in the morning; was at the Hague at one; at Amsterdam at half past one; at Embden at four; at Hamburg at six; at Lubeck, Blockede, and Salzwedel at seven; and at Stettin at half past nine at night. The tempest travelled at the rate of 120 feet a second, or upwards of eighty miles an hour. The cross and ball of St. Paul's vibrated fearfully, and were expected to fall. A similar terrific hurricane raged upon our coasts January 6 and 7, 1839, which blew with extraordinary fury over Ireland, in the central parts of which stormy petrels were found dead, when the wind was lulled to rest. Rotary gales were also experienced February 28, 1849, and February 5 and 6, 1850. On the cause of these awful phenomena we must be silent in the present state of our knowledge, though probable opinions have been started. Happily, like “coming events” which “cast their shadows be-

fore," their approach is, announced by atmospheric indications of change and a rapidly falling barometer, warning the mariner to prepare for the hour of peril. When the centre of the gale has passed, the mercury remounts the tube. "The wind bloweth where it listeth," in complete independence of the power of man, nor can human sagacity tell beforehand when and where the march of the tempest will be stayed. It nevertheless follows a prescribed course, in obedience to His laws who "bringeth the wind out of his treasuries;" and who once elicited the admiring exclamation, by a display of authority, "What manner of man is this, that even the winds and the sea obey him!" The thought is a consoling one to the Christian, when the tremendous powers of nature are in energetic action, that they are all to him under the guidance and control of a friendly Hand. It is also true, that like so many other apparently hurtful events of life which are overruled for good, and are thus blessings in disguise, the dread hurricane ministers to the recovery of the atmosphere from a vitiated condition, upon which its life-conserving power depends, and is thus comprehensively beneficial, while to a limited extent destructive.

A local storm-wind of great violence is frequently encountered by the tourist in the lake-district of our northern countries, called the helm-wind. Upon the summits of the lofty ridge of mountains at Hartside in Cumberland, of which Cross Fell is the chief, there often hangs a vast line of clouds, apparently in a sullen, drowsy state, exhibiting little movement. To this collection of vapours the term Helm is applied from its helmet-shape. It extends several miles in length, dips from the summit half-way down to the base of the eminences, while, at the same time, the other mountains

in view to the westward are clear of mist, and show no sign of rain. The whole appearance is singular, solemn, and awful, for, while the upper parts may be tinged with white by the sun's rays, the lower are dark, and spread a gloom over the regions below like the shadows of night. Parallel to this, another line of clouds, called the Bar, begins to form. The two lines unite at their extremities, and inclose between them an elliptical cloudless space, from half a mile to four or five miles in breadth. Soon after the complete formation of the Helm-Bar, a violent wind issues from the space between the clouds, generally blowing directly from the east, and with such power that heavy vehicles have occasionally been overturned, hay and corn stacks dispersed, and the trees completely stript of their foliage. "As we proceeded towards Penrith," says the Rev. T. Hartwell Horne, "the bleak Cross Fell arose to view in the distance on our right, a long ridge of mountains whose summits were covered with snow. From the force and direction in which the wind met us, we were informed that the helm-wind was then blowing down that fell and the adjoining Token-fell. We observed a thick cloud on the summit, covering it like a helmet, whence this phenomenon takes its name, and at some distance from it, in an opposite direction, a thick, undulating mist, apparently more dense than those which usually rise from the lofty mountains of this country. These appearances, we were told, were certain indications of the existence of the helm-wind, which blows with tremendous fury." The wind is very varying in its duration, from a few hours to as many days. It has been suggested in explanation, that the air from the coast of Northumberland, being cooled as it rises to the summit of the mountains, and there condensed, descends from

thence with great force by its gravity into the district to the west of Hartside, the scene of the phenomenon.

HUMIDITY of the atmosphere, with the frequent precipitation of rain, eminently distinguishes the British climate. This is the necessary result of an insular position, and contributes to render the pastures so freshly verdant, while those of the continent, away from the coast, are brown or ashy, parched with autumnal drought and heat. This verdant aspect is specially characteristic of Ireland, and has won for it the title of the "green" or "emerald isle;" for, though its average quantity of rain does not probably exceed the amount in Great Britain, it is more equally diffused throughout the year, rendering the number of the rainy days greater, while, the air being more constantly moist, mists are prevalent when there is no precipitation. The dampness of the Irish climate, a standing subject of complaint with all tourists, not a little exaggerated by their disappointments, is a benefit rather than a disadvantage to a people only acquainted with, or able to adopt, a rude system of tillage. Natural fertility is induced by it, where otherwise there would be barrenness; and soils of indifferent quality, tracts of mountain or rocky ground, apparently repelling cultivation, are clothed with a fresh and wholesome herbage, or made to produce crops supporting a considerable population. The damp climate aids the poor man in his labours by forcing vegetation in spite of indifferent culture, whereas a dry climate would require more perfect tillage to render the ground productive.

The atmosphere is not equally moist in all parts of the kingdom, or in all seasons of the year. Owing to the immense extent of evaporating surface presented by the

ocean on the west and south-west, with the prevailing winds from these points, and the position of the mountains, upon which the clouds strike, and discharge the greater part of their burden, the amount of rain is far more copious in the western than in the eastern districts. The following are some results of the annual fall, limited to England, obtained by the rain gauge :

WESTERN STATIONS.		EASTERN STATIONS.	
	Inches		Inches
Penzance	45	London	21
Plymouth	46	Hastings	23
Exeter	35	Hertford	25
Salisbury	35	Upminster	19
Bristol	30	Aylesbury	21
Cheltenham	32	Thetford	19
Liverpool	35	Norwich	25
Manchester	36	Cambridge	20
Bolton	47	Boston	25
Kendal	56	York	23
Whitehaven	52	Thursk	24
Keswick	70	Shields	25
Seathwaite (Derwentwater)	146	Widdrington	21

The amount of rain in the western districts is thus vastly in excess of the quantity in the eastern. The average annual quantity for the whole of the United Kingdom is certainly not over-estimated at thirty inches, or a depth of two feet and a half of water if evenly distributed over the surface. About two-thirds of the whole rain, snow, and hail coming from the clouds is carried off by evaporation, absorption, and vegetation, the remaining third finally arriving at the sea. The number of days in the year in which rain descends is as follows at the respective localities :

	Days.
The Cornish peninsula	180
Devon, Dorset, and adjoining districts	170
London and South-Eastern counties	180
Midland Counties	150
South Lancashire	180
Northumberland	150
East Coast of Ireland	200

The greatest proportionate amount of rain falls in winter, on the west coast of Ireland; in summer, on a section of the east of England, embracing the counties of Norfolk and Lincoln, the East Riding of York, with parts of the counties of Nottingham, Northampton, and Cambridge; and in autumn through the remainder of the kingdom.

It is an interesting question, whether, and to what extent, the climate of the country has undergone alteration since the date of authentic history. There is no reason to suppose that the superficial temperature of the globe has experienced any perceptible change since the existence of man upon its surface. Yet throughout Europe generally, and Britain in particular, it is very probable that temperature is more equably distributed now than formerly—summer heat and winter cold not being so violently contrasted—owing to the cutting down of the natural forests and the operations of human industry in drainage and cultivation. In the time of the Romans, such rivers as the Loire, Rhone, Rhine, and Danube, were regularly frozen, so that armies passed over them, with their baggage; snow was common in the streets of Rome, and the ice had to be broken to get at the water of the Tiber; the reindeer, now confined to regions considerably north of the Baltic, was located, along with the elk and the wild bull, in the Hercynian forest, which then overshadowed great part of Germany and Poland. Virgil, in his *Georgics*, gives directions for the protection of sheep and goats from snow and frost, as if addressing a shepherd of the Scottish highlands.

Some of the excessive winters on record may be noticed:

A.D.

250. The Thames frozen for nine weeks.

291. Most of the rivers in Britain frozen for six weeks.

A.D.

359. A severe frost in Scotland which lasted fourteen weeks.
598. So severe a frost all over Britain that the rivers were ice-bound more than two months.
695. The Thames frozen over for six weeks, and booths erected upon it.
827. A frost in England which lasted nine weeks.
908. Most of the rivers in England frozen for two months.
923. The Thames frozen for thirteen weeks.
1063. The Thames frozen for fourteen weeks.
1281. "From this Christmas," says Stow, "till the Purification of our Lady, there was such a frost and snow as no man living could remember the like." At the thaw, five arches of London-bridge, and all Rochester-bridge, were carried away by the flood.
1339. The crops failed in Scotland owing to inclement seasons, and such a fearful famine was the result that the poorer people were reduced to feed on grass, and many perished miserably in the fields. Yet at this time wheat was sold in England at three shillings and fourpence a quarter.
1410. "This year," says the Chronicle of the Grey Friars of London, "was the great frost and ice, and the most sharpest winter that ever man saw; and it dured fourteen weeks, so that men might in divers places both go and ride over the Thames."
1434. The Thames frozen below London-bridge as far as Gravesend, from December 25 to February 10, 1435, when "the merchandise which came to the Thames' mouth was carried to London by land."
1506. "Such a sore snow and frost that men might go with carts and horses over the Thames, and it lasted till Candlemas."—Chronicle of the Grey Friars.
1515. The Thames frozen, and passed by vehicles over the ice from Lambeth to Westminster.
1564. Frost set in December 21. Stow and Holinshed state that on New Year's Eve "people went over and along the Thames on the ice from London-bridge to Westminster. Some played at the foot-ball as boldly there as if it had been on the dry land; divers of the court being then at Westminster shot daily at marks set

upon the Thames; and the people, both men and women, went there in greater numbers than in any street of the city. On the third day of January, at night, it began to thaw, and on the fifth there was no ice to be seen between London-bridge and Lambeth, which sudden thaw caused great floods and high waters, that bare down bridges and houses, and drowned many people in England."

1608. A hard frost commenced on the 8th of December, and continued to the 15th, when it thawed. On the 21st, it began to freeze again, and the Thames was passable at a few places on the 30th. From January the 10th to the 15th, 1609, the ice became firm, and was crowded. Fruitsellers, victuallers, shoemakers, and barbers, erected booths upon it for their respective callings. The frost lasted till February the 2nd. It is described in a rare tract entitled "Cold Doings in London."
1609. The following winter was still more severe. Frost commenced in October, and lasted four months. The Thames became a highway for the heaviest vehicles.
1614. The longest snow-storm ever known in Great Britain. It is recorded in the register of the parish of Wotton Gilbert, that it began on January 5, and continued to snow at intervals of every day till March 12. An immense number of human lives and of cattle were lost.
1620. The "thirteen drifty days" designate in Scotch annals a dismal snow-storm, the memory of which long survived in the traditionary stories of the shepherds, and was oft recurred to at their hearths. The snow fell during that interval day and night with very little intermission, accompanied with great cold, and a keen biting wind. About the fifth and sixth days, the young sheep fell into a torpid state and died; and about the ninth and tenth, the shepherds began to build up large semi-circular walls of the dead, in order to afford some shelter for the living. But the protection was of little service. Impelled by hunger, the sheep were frequently seen tearing at one another's wool with their teeth. On the fourteenth day, when the storm began to abate, there was not a single survivor of extensive flocks to

be found on many a high-lying farm. Large misshapen walls of dead, surrounding a small prostrate group, likewise dead, and stiffly frozen in their lairs, met the eye of the forlorn shepherd and his master. Out of upwards of twenty thousand sheep maintained in the pastoral district of Eskdale moor, only about forty-five were left alive.

A.D.

1674. On the 25th of February, a great snow began to fall about eight in the morning, and continued for four days with little intermission, the frost being at the same time very severe. The whole country was covered several feet deep, and every description of business was brought to a stand still. Many persons were frozen to their saddles, and, according to the records of the time, saddle and man were removed from the horse together. A great number lost their lives by being buried in the snow, besides much cattle. On the 8th of March, the frost having continued till then, another heavy fall of snow came on, which lasted till the 18th. The weather then suddenly changed: and rain ensued, with such a rapid thaw, that the waters everywhere rose, and the whole country was inundated. Bridges and buildings were swept away by the floods, and many people utterly ruined.

1683. In the beginning of December, the "Great Frost" commenced, lasting till the 5th of February, 1684, about thirteen weeks, without any abatement. Oaks and forest-trees were split; most of the hollies were killed; almost all the birds perished; and the sea was frozen several miles from the shore. Coaches plied on the Thames from Westminster to the Temple; an ox was roasted on the ice near Whitehall; and all kinds of trades were carried on upon the river. Printers transferred their presses to it, and earned considerable sums by printing the names of people for sixpence each. Charles II. visited the strange scene, and had his name, with other members of the royal family, "Printed by G. Groom, on the Ice, on the river of Thames, January 31, 1684," according to the inscription on a sheet of coarse Dutch paper. The king died February 6, the day after the break-up of this great frost.

A.D.

1688. Five years afterwards the same scene was renewed on the Thames, the frost lasting from December 29 to February 6, 1689.
1709. Printing was again conducted on the Thames, January 7. So rigorous was the season all over Europe that it is known by way of distinction as the "cold winter." All tender shrubs and vegetables in England were killed; the fields were strewn with dead birds; and men perished in their dwellings. The frost is said to have penetrated three yards into the ground; and the sea was frozen to the distance of several miles from the shores.
1715. Severe frost prevailed from the close of November to February 9, 1716; and a fair was held on the Thames.
1739. Frost commenced on Christmas-day, and lasted several weeks, marked with intense cold. All the lakes in England were frozen over; many trees were killed; and postilions perished on their saddles. The winter was remarkably severe everywhere in Europe. At Leyden the thermometer fell 10° below the zero of Fahrenheit. The Zuyder Zee was passable on the ice. Snow lay from eight to ten feet deep in Spain and Portugal. The frost broke up so suddenly, that the booths, shops, and huts, erected on the Thames, were lost in it, owing to the separation of the ice.
- The successive winters of 1766, 1767, and 1768, were very cold all over Europe.
1789. The Thames was firmly frozen January 8, and soon crowded with booths, shops, and

"A press to print where men so oft were drown'd."

The watermen broke the ice close to the shore, and erected bridges, with toll bars, to make every passenger pay a halfpenny for access to the river. Vast quantities of boiling water were poured upon the bridge water-works every morning to set the wheels in motion; and twenty-five horses were employed daily in removing the ice from them. Masses of ice eighteen feet thick were observed at Blackfriars. The sudden break-up of the surface, with the rush of the people

to the shores, at night, was a fearful scene. A vessel lying off Rotherhithe, fastened by a cable and anchor to the beam of a public-house, veered about, pulling the building to the ground, and killing five inmates in their beds.

A.D.

1795. The cold was excessive at the commencement of the year, attended with violent snow-storms, one of which, in the night of January 24-25, was specially severe in the south of Scotland, from Crawford-muir to the Border. Seventeen shepherds died; upwards of thirty were carried home helplessly benumbed; and the sheep perished in numbers beyond example in the district. So completely were the flocks overwhelmed that no one knew where they were till the thaw exposed them. Many were driven by the violence of the gale into the streams, where they were frozen up, and finally carried out to sea by the subsequent floods. At the beds of the Esk, in the Solway Firth, a place where the tide throws out and leaves whatever is borne into the estuary by the rivers, there were found the bodies of 1840 sheep, 9 black cattle, 3 horses, 2 men, 1 woman, 45 dogs, 180 hares, besides a large number of inferior animals.

1799. During an extremely severe winter, the remarkable case occurred of a woman being entombed in the snow for eight days, and taken out alive. Towards night, on the 2nd of February, Elizabeth Woodcock was returning from market, along the road between Cambridge and Trumpington. Much snow had fallen during the day, and had been drifted to a considerable height by a violent wind. Being benumbed, she fell into one of the drifts, and, being unable to make the necessary efforts to extricate herself, was quickly covered by the still falling flakes. In this distressing position she remained till the morning of the 10th, when, a thaw having taken place, she was discovered and rescued. But, owing to injudicious treatment, she died on the 13th of July, after having suffered severely for five months. During her melancholy imprisonment, she was frequently tantalized by hearing the sound of car-

riages on the road near her, the different cries of the animals in the fields, and the bells of the neighbouring village churches pealing on Sunday, while passengers passed by her so close, that she could plainly hear the words spoken in conversation.

- A.D.
1814. A memorable frost commenced a few days before the beginning of the year, with a thick fog, followed by a heavy fall of snow for two days. For four weeks the wind blew almost uninterruptedly from the north or north-east, and the cold was intense. The Thames was covered with vast heaps of floating ice, bearing huge piles of snow, which becoming compact towards the close of January, the unemployed watermen commenced their ice-toll. Streets of booths were speedily formed, one of which bore the name of the "City Road." Sheep were roasted whole, and slices of the "Lapland mutton" sold to the crowd. The printers plied their craft, and struck off the record for sale :—

" Amidst the arts which on the Thames appear,
To tell the wonders of this icy year.
Printing claims prior place, which at one view
Erects a monument of That and You.

Printed on the River Thames, February 4, in the 54th year of the reign of King George III., Anno Domini 1814." A duodecimo volume of more than a hundred pages appeared, entitled "Frostiana; or, a History of the River Thames in a frozen state, with an account of the late severe frost." London. Printed and published on the Ice on the River Thames, Feb. 5, 1814, by G. Davis." But scarcely had this work been completed when the ice broke up in all directions, and floated away with printing-presses, booths, and stalls.

1836. The greatest snow-storm in England of the present century occurred on the night of December the 24th. It was remarkable for its extent as well as violence, while the wind blew a hurricane. Snow covered the 60,000 square miles of England and Wales, in many places to the depth of several feet; and all the roads in the kingdom were either obstructed or rendered quite impassable, till cuttings had been made through

the drifts, which often ranged from ten to twenty feet. At Lewes, an avalanche fell from the cliffs, destroying a number of houses, and burying the inhabitants in the ruins. The storm prevailed over the north of Germany, all Holland, and the greater part of France and Spain.

A.D.

1854. The year opened with the daily temperature being much below the usual average. But on the night of January the 2nd the thermometer registered a greater degree of cold than had been experienced by the vast majority of persons living. This severity was remarkably limited to the country between the parallels of 51° and 54° , those of Winchester and York; and was most intense towards the centre of this zone. About London and its vicinity, early in the morning of the 3rd, the temperature fell to 12° , 11° , and 10° ; but in several parts of the midland counties it was as low as zero. It was noted by Mr. Lowe, at the Highfield House Observatory, near Nottingham, at -4° , or thirty-six degrees below the freezing point. This was the lowest reading recorded by any one with trustworthy instruments. About the time of these low temperatures, a heavy fall of snow took place; and the wind blew a gale from the east. In the parks of London, the snow averaged a foot in depth; on the Norfolk coast, one foot and a half; about Derby and Grantham, some of the drifts ranged to fifteen feet; but south of the parallel of 51° , and north of that of 54° , the fall was very slight. At Allenheads, in the mountainous part of Northumberland, there was none. In a few days the weather was warm.

1855. The year opened under circumstances the reverse of those of the preceding, for the daily temperature was considerably above the usual average. But frost commenced January the 14th, and did not give way till February the 23rd, giving us what aged persons styled one of the "old fashioned winters." During this period, the cold was at times fully equal to that of the foregoing season. Milk froze upon the milkers' hands as they were at work. The Severn was passable on the ice from Gloucester to Worcester, a distance of thirty-

two miles. Windermere and the smaller lakes were skating-grounds ; and most of the ports were ice-bound. The Thames was blocked up ; and would have become a firm highway, if the frost had lasted a day or two longer. Vast quantities of ice were seen drifting in the Downs and the Channel—a very rare occurrence. But the remarkable feature of the season was the peculiar character of the snow, which fell in frequent though not heavy showers. It was composed for the most part of crystallized particles of compound figure, formerly supposed to be confined generally to high latitudes, and therefore designated “polar snow.” The crystals were of exquisite beauty, and very varied in form. Mr. Glashier, the meteorologist, observed a great number of plane hexagons on the morning of February the 8th. Some of these were of transparent laminae, beautifully marked with successive and inner tracings. As the morning advanced, they became intermixed with others set round with solid hexagons, which continued to fall until an hour before noon. Few crystals fell from that time to four o’clock, after which, innumerable examples of arborescent shape were discerned. The nucleus of the greater number was a plane hexagon marked with inner parallel tracings, from which sprang radii, each of which intersected a crystalline formation, very similar in appearance to the pinnæ of the Lady Fern. As the evening advanced, these became less prevalent, and mingled with almost every variety which had fallen during the day. “When,” says Mr. Glashier, “I went out, at long past midnight, the snow sparkled everywhere with crystals, as granite sparkles with the grains of mica : every leaf, cobweb, knotty projection, and sheltered nook, bore its burden of drifted snow and glistening crystals. It was a night to be remembered for the extreme loveliness of nature arrayed in her most wintry garb.”

A similar record of excessive summers might be given. But, however great the range of the thermometer in the course of a single year, or the degree of cold and heat

that may be registered, a comparison of years shows that the annual average peculiar to the locality is remarkably uniform, neither an unusually rigorous winter nor a warm summer causing it to fall below or rise above the standard mean. It is, however, a probable inference from the chronicles of past seasons, that, while the mean annual temperature has undergone no alteration, our summers and winters are now less frequently in violent contrast to each other than some centuries ago, the climate having been rendered more equable through the different months by those operations of human industry which have so largely modified the surface of the country. This is unquestionably a change for the better. It ministers to the general comfort of society, while the poor are spared severe privations, and thousands of the working-classes are exempted from those long suspensions of labour which necessarily bring famine to their doors, at a time when the most support is needed, owing to the inclemency of season.

CHAPTER VIII.

GENERAL BOTANICAL FEATURES.

Vegetation of Islands—Asturian, Armorican, Scandinavian, and Germanic Types—British Cryptogamic Plants—Sea-weeds—Vraic of the Channel Islands—Fungi—Lichens—Mosses—Ferns—Phænogamic Vegetation—Number of Species—Examples of General and Limited Distribution—The Grasses—Field Flowers—Dial Flowers—Marsh and Aquatic Plants—Samphire—Poisonous Plants—Nettle Tribe—Climbers—Flora of Heaths—The Rose, Thistle, and Shamrock—Fruit Plants—The Woodlands—Forests—The Alder, Ash, Beech, and Birch—The Elm, Hawthorn, Holly, Maple, and Mountain Ash—The Oak, Pine, Poplar, Willow, and Yew—Introduced Timber Trees

SOME insular spots remote from a main shore have a distinct and limited native flora; but in general the indigenous vegetation of islands corresponds to that of the adjoining continents. Thus, all the plants of Great Britain and Ireland, not introduced by man, are found on the mainland of Europe, with the exception of two or three species, which have come from the western world, without having been intentionally brought over. One of these migrants from a far country, the three-toothed cinquefoil, *Potentilla tridentata*, is abundant in Arctic America and on the Rocky Mountains, and occurs upon a hill in Forfarshire, which is its only European station; but how it got there, and when, are alike unknown. A second wanderer from the opposite side of the Atlantic, the jointed pipewort, *Eriocaulon septangulare*, is found in the Hebrides, and on the west coast of Ireland, and has doubtless established itself in these districts from seeds floated thither by the Gulf-stream, which have retained their power of germination. Recently, a water-

weed, *Anacharsis Alsinastrum*, has intruded itself from the same quarter, and overrun with great rapidity canals, drains, and rivers, displacing the aboriginal vegetable inhabitants. It was first noticed in the year 1842, but did not attract much attention till 1847, when navigation was impeded by it in the canals of the midland counties, in the Trent, and in the rivers of the Wash. The plant is independent of a root in the soil, for it grows after being cut as it travels with the stream, and forms tangled masses abridging the navigable area of the waters. But the interesting fact has been ascertained that swans feed upon it with avidity, and will be useful in keeping it down. It is supposed to have been introduced by seeds connected with Canadian timber, during the construction of the railways. In 1836, the land received a vegetable pest from Odessa, in the parasite familiarly called dodder. It came with a consignment of flax seed to Westport, in the county of Mayo, Ireland, and has since extended itself to the fields of England, Wales, and Scotland, investing the crops of flax and clover with its pale reddish threads, and living upon them to their detriment.

While the flora of the country is European, it corresponds in different districts to that of distinct continental sites. Hence four botanical regions are discriminated within it, respectively called **ASTURIAN**, **ARMORICAN**, **SCANDINAVIAN** or **Boreal**, and **GERMANIC**, each being more or less abundantly characterized by types of the vegetation common to those localities of the continent.

The **ASTURIAN** type occurs in the south-west of Ireland, and is limited to it. In that district, twelve or more species of plants flourish in a wild state, which are found in the Asturias, on the opposite north coast of

Spain, but are not known really wild in any other part of our islands. Some characteristic examples may be mentioned—St. Patrick's cabbage, *Saxifraga umbrosa*, plentiful on the mountains, also called London-pride, from being cultivated in the gardens of the metropolis, and from its beautifully spotted flower; the Irish Menziesia, *Menziesia polyphila*, or St. Dabeoc's heath, abundant in the wild tract of Connemara; the Mediterranean heath, *Erica Mediterranea*, in the same quarter; Mr. Mackay's heath, *Erica Mackaiana*, named after its discoverer in the same locality, being the only station of the plant at present known, except the Sierra del Peral, in the Asturias, where it was found in the same year that it was in Ireland; the arbutus or strawberry-tree, *Arbutus unedo*, which adorns with its vividly evergreen foliage and bright red berries the banks of the lakes of Killarney, the woods of Muckross Abbey, and Glengarriff, near Bantry. The tree thrives so luxuriantly that a trunk has been measured from nine to ten feet in girth. It is supposed not to be indigenous, but introduced by the monks of St. Finian, who founded the abbey of that name at Killarney in the fifth century. Though perfectly naturalized in this one spot, it is found nowhere else in a wild state either in Great Britain or Ireland.

The ARMORICAN type appears in the south-east of Ireland and south-west of England, where the vegetation is intimately related to that of the opposite coasts of Brittany and Normandy, the ancient Armorica; and many species occur which are precluded from migrating farther north by the increased cold of the climate. The Cornish heath, *Erica vagans*, the graceful little creeping Sibthorpia, *Sibthorpia Europæa*, the balm-leaved fig-wort, *Scrophularia scorodonia*, and the least

gentianella, *Cicendia filiformis*, are found in both the Irish and English localities. But the beautiful ciliated heath, *Erica ciliaris*, the Cornish bladder-seed, *Physospermum Cornubiense*, the rare acrid lobelia, *Lobelia urens*, the narrow-leaved hare's-ear, *Bupleurum aristatum*, four-leaved all-seed, *Polycarpon tetraphyllum*, sand strap-wort, *Corrigiola littoralis*, linear-leaved St. John's-wort, *Hypericum linarifolium*, and white mountain rock-rose, *Helianthemum polyfolium*, are alone English. So genial is the climate in sheltered bays of our south-western coast that myrtles, citrons, camellias, hydrangeas, magnolias, cactuses, and other tropical plants bear unharmed the open air of winter, without any protection but what is afforded by the neighbouring hills. Myrtles at Penzance commonly attain the height of from ten to twelve feet, and may be seen trained on the front of some of the houses to double that height.

The SCANDINAVIAN or Boreal type is developed in the Highlands of Scotland, more sparingly on the mountains of Cumberland and Wales, while far more slightly in Ireland, where the elevations are generally inferior, and the climate milder. It consists of plants common to Alpine heights and Arctic lowlands. Besides lichens, mosses, and grasses, this vegetation includes flowering species of great beauty, and several berry-bearing shrubs of value. Among the latter are the bilberry, *Vaccinium myrtillus*, the red whortleberry or cranberry, *Vaccinium Vitis-idaea*, and the cloudberry, *Rubus chamaemorus*. The former two grow plentifully on bleak moors and heaths of no great elevation, and range from thence to a considerable height, but are less patient of cold than the cloudberry, which flourishes

with us only in very high and exposed situations—on the sides and towards the summits of the loftiest mountains—and has perhaps its name from bringing forth fruit literally in the region of the clouds. A single berry grows at the top of the stem, about the size of a small strawberry, and is remarkable for its fine sharp flavour, which deteriorates under cultivation. The plant is chiefly found in the wilder parts of the Scotch Highlands, where the fruit is annually gathered, though it is by no means there commonly diffused. Elegance of shape and richness of colouring, general features of the flora of mountains, are conspicuous in the Alpine forget-me-not, *Myosotis alpestris*, the blue rock speedwell, *Veronica saxatilis*, the silver-leaved lady's mantle, *Alchemilla alpina*, and the moss campion, *Silene acaulis*. The latter is remarkable for the purple cushions it forms, some feet in diameter, of the beauty of which no conception can be formed without actual observation. One of our arborescents rises to the region where the ptarmigan has its summer home, the herbaceous or least willow, *Salix herbacea*, a tiny plant, scarcely attaining the height, or rather the length, of a few inches, and hardly to be seen but for its brightly-coloured catkins.

The GERMANIC type is diffused through the entire British archipelago, and comprehends the main mass of the vegetation, the arborescents, shrubs, weeds, and wild-flowers most familiar to us, which are also found in central Europe. The orchids, and other well-known chalk plants of the south-east of England, where the rocks of the cretaceous system are principally developed, are also common to the opposite coasts of France, where the same formation occurs. But it is remarkable, that species in England which flourish best on limestone

have not migrated to the great limestone district of Ireland; and, in like manner, certain species which everywhere delight in sand are wanting on such Irish localities as seem best adapted to them. All plants generally spread in the British islands are Germanic.

CRYPTOGAMIC VEGETATION.

Few parts of the globe of the same extent are so richly supplied with cryptogamic or non-flowering plants, *algæ*, *fungi*, *lichens*, *mosses*, and *ferns*. These are the humblest forms of the vegetable kingdom, yet not the least beautiful, and by no means unserviceable. They range in their station from the bed of the ocean to the tops of the highest mountains, and rank as citizens of the world, being endowed with capacity to endure great vicissitudes of climate.

Marine *algæ*, or *sea-weeds*, are plentiful along the coasts, differing in species with the latitude, and in colour with their position. Some are permanently submerged; others occupy the shore between high and low water mark, and are thus alternately exposed to the action of the atmosphere and the briny deep; but none of them can be made to vegetate apart from the salt water. Green sea-weeds occur near high-water mark, and in shallow tide-pools within the tidal zone; olive-coloured sea-weeds flourish between high and low water mark; and red sea-weeds increase in number, and deepen in colour, as they are withdrawn by the billows from atmospheric influences. A species common in the North Sea is frequently found of the length of from thirty to forty feet, and forms subaqueous forests in some bays of the Orkneys, through which a pinnacle with difficulty

forces its way. Other kinds, commonly called dulse and tangle, were formerly used for food by the poorer classes in Scotland and Ireland, and still serve as fodder for sheep, cattle, and horses during the winter months. "Who'll buy dulse and tangle?" was once one of the street cries of Edinburgh; and rich as well as poor were glad to avail themselves of such humble fare, in the oft-recurring times of scarcity with which the country in a bygone age was familiar. In some districts, sea-weed is converted into size for the use of house-painters; kelp is obtained from it in great abundance for glass-making and soap-boiling; and iodine, valuable in medicine, is derived from the plants themselves, or from kelp.

A particular species of sea-weed, *fucus marinus*, locally termed "vraic," is extensively used in Jersey and Guernsey, both as fuel and manure; and so highly is it prized for the last purpose, as the islands have no lime nor chalk, that the people have a proverb in their patois, "*Point de vraic point de hautgard*"—no sea-weed, no corn-yard. The oldest existing records prove it to have been used from time immemorial; and its growth is stringently protected by the laws, which only allow the vraic to be cut from the rocks during a limited period in summer and winter. Even the drift-weed, thrown upon the beach by the waves, is the subject of regulations, which portion it out among the proprietors and occupiers of land, according to the extent of their respective estates or holdings. It is used in different ways, being either spread fresh upon the ground, and then ploughed in at once, or allowed to decompose upon the surface, or burned to ashes. In any state, the weed is highly beneficial to the soil, by its unctuous and saline properties. But the ashes form a better manure than

the fresh plant; and the poor, after burning it during the winter as fuel, for which purpose they dry it in the sun, are able to obtain, in exchange for eight measures of these ashes, one measure of wheat. The appointed seasons for gathering the *vraie* are high festive occasions, as well as times of unusual industrial activity.

Of the *fungi*, one of the lowest forms of vegetable life, and abundant in moist situations, we have species poisonous to the human system, and injurious to timber and the corn-plants, with others which are edible, as the mushroom and truffle. The latter, a subterranean plant, grows a few inches beneath the surface, and is therefore styled the ground mushroom. Diffusing a peculiar odour when ripe, it is hunted by dogs trained for the purpose of finding it; and it is used in the more expensive and luxurious kinds of cookery. It is principally found in the chalky parts of Sussex, Hants, and Wilts, and realizes a high price in Covent Garden Market.

Lichens are distributed from the loftiest summits of the Highlands to the stones by the sea-shore, and the gloomy depths of deserted mines. These patches of variously-coloured, leathery vegetation, yellow, crimson, gray, brown, and of more sombre hues, which paint the weather-beaten rocks, the walls of old castles and churches, the trunks and branches of trees, are curious and interesting objects. The singular lichen called the Lungs of the Oak remarkably resembles the lobulated appearance of the human lungs. Another, well-known as the Old Man's Beard, is so named from its general hue and aspect, drooping from the branches of trees in thick beard-like tufts. The goblet lichen, found upon many of our heaths; the crab's-eye lichen, common upon stones; and the hair-like

lichen, clothing oak-trees with a shaggy mantle, exhibit other varieties of form. These humble plants have no inconsiderable economic value. A species known as cudbear, *Lecanora tartarea*, yields a purple dye, and grows abundantly on the limestone of Derbyshire and the rocks in the north of Scotland, where it is collected by the peasantry, and sold to the dyers. But the importation of another lichen, the archil, from the Canaries, yielding a more brilliant colour, has abridged the use and lowered the value of the native product. The archil, *Roccella tinctoria*, from which the chemical test called litmus is prepared, occurs in the Scilly islands, which are its northerly limit, but so scantily as not to be worth gathering. The rounded spots of white powdery substance frequent upon the trunks of the ash, intensely bitter to the taste, produce oxalic acid. The lichen called Tripe de Roche, the food of the Canadian hunters when deprived of other resources, and the Iceland moss or lichen, sold in our shops as a medicine, are also British, as is the rein-deer lichen, which forms the only diet of that valuable animal during the prolonged northern winters.

The *Moss* family, less susceptible of useful applications than the preceding tribe, but far more beautiful, is represented with us by upwards of three hundred species, which attract attention from flourishing most when flowers have faded, trees have lost their foliage, and vegetable nature has a generally dreary aspect. They differ widely in hue, from the freshest and deepest green to bright yellow, brown, red, or rose-colour, and also in size and form; but all are remarkable for beautifully symmetric shapes, with extreme minuteness yet perfect finish in their details. The "horse-tail," "ostrich-plume," and "crested feather" mosses are so

called from their resemblance to the objects named. Though yielding no perfumes, dyes, or textile materials, and not used as food by men or animals, the feathered race and smaller quadrupeds, as the dormouse and squirrel, are not negligent of the soft mosses in building their nests and winter habitations, while this humble vegetation is most influential in filling up pools, and forming bog-soil, the substratum of which, becoming compressed, is converted into peat.

Like the mosses, the *Ferns*, of which we have about sixty species, are most ornamental and freshly green in the ungenial seasons of the year. These plants, distinguished by a gracefulness of air and delicate symmetry of form scarcely known to any other tribe, commonly wave their verdant fronds far from the haunts of man, among dripping rocks, or in the depths of shady woods.

“ Where the copse wood is the greenest,
Where the fountain glistens sheenest,
Where the morning dew lies longest,
There the Lady Fern grows strongest.”

But members of the family occupy a great variety of situations. The filmy ferns flourish within reach of the spray of waterfalls, where they are constantly kept in a moist condition; but the little wall rue, on the other hand, establishes itself in crevices of some old castle or ruined building. The Alpine shield fern ascends the mountains, and belongs to the true Alpine flora; and the marine spleenwort takes up its abode in the wildest parts of the sea-coast. The lovely maiden-hair fern grows from the sides of moist rocks and caves; while the bracken or brake of the poets is very generally distributed over the country.—“The wild buck bells from ferny brake.” In sheltered hollows of the

Highlands, it grows in great luxuriance, often attains the height of five or six feet, and forms a convenient covert for the red-deer. The ferns are of small economic value, being chiefly used for thatch, packing fruit, and the protection of other plants from frost.

PHENOGRAMIC VEGETATION.

The total number of flowering plants comprised in the indigenous flora of the kingdom is commonly estimated at about 1,500 species. Of these, about 1,150 species are *dicotyledons*, or plants with two seed-lobes, also called *exogens*, from the stems growing by successive additions to the exterior tissues, and form the most perfect and beautiful class, embracing the principal forest-trees. The remaining 350 are *monocotyledons*, or plants with only one seed-lobe, which increase by successive additions to the centre, and are therefore called *endogens*, as lilies and the numerous grasses. Numerical estimates of species in our flora vary to some extent, owing to opinions differing respecting certain plants, as to whether they belong to the proper spontaneous vegetation, or have been introduced by man.

Species which may be peculiarly called *British*, because very widely spread over England and Scotland, forming some principal components of the vegetation, include most of the timber trees, the oak, wych-elm, birch, alder, ash, willow, yew, holly, hazel, and black-thorn, with many of the grasses, the common daisy, dandelion, and dog-rose. Species peculiarly *English*, not ranging northward into Scotland, comprise the common elm, beech, and maple, with several striking and ornamental field flowers, as the sweet violet, daffo-

dil, star of Bethlehem, mezereon, black bryony, traveller's joy, and the mistletoe. Species exclusively *Scottish* belong chiefly to the true Alpine flora. But, while in Great Britain there are plants limited to southerly and northerly localities, there are others peculiar to the *eastern* or *western* sides of the island, between which regions there is a considerable difference in the mean temperature of the winter, the coldest winters occurring on the east coast. Thus, the pale butterwort, *Pinguicula Lusitanica*, a plant very impatient of cold, is found on the west coast of Scotland, the west and south of Wales, and generally in the south-west of England, ranging eastward into Hampshire; but it is nowhere found on the eastern side of the island from the Strait of Dover to the Moray Firth.

The common *grass* of the field is popularly suggestive of but one idea. Many a passer-by, when looking over an inclosure, is quite ignorant of the fact, that the family of the *grasses* consists of from 3,000 to 4,000 species, nearly 150 of which are natives of Great Britain, so that in gazing upon a meadow or pasture thirty or forty distinct varieties may be under the eye at once. Linnaeus delighted to assemble his favourite pupils around him at his villa of Harmanby, near Upsal, to botanize at leisure, and blend instruction with the hospitalities of life. On one of these occasions, the students found him in a beautiful meadow, clad in a morning gown, with a velvet cap upon his head. Reclining on the ground, and laying his hand upon the grass, the naturalist said to one of them, "Come hither, child—how many different kinds of plants do you think I cover with my hand?" A number was named at random; he found that there were more; and, after discriminating the species, he added, "Judge from this, friend, the num-

ber of plants that grow on the face of the earth, and how very great that Being must be who created them." Pieces of turf, one foot square, cut from rich old pasture ground in Endsleigh, Devonshire, for the purpose of examination, yielded thirteen distinct grasses, with eight other plants of different kinds. Out of the great number of our natural grasses, there are not more than sixteen or seventeen of value to the farmer; but these constitute the foundation of his wealth, as they are the chief food of the most important domestic animals. The sweet-scented vernal grass, *Anthoxanthum odoratum*, meadow fox-tail, *Alopecurus pratensis*, Timothy or meadow cat's-tail, *Phleum pratense*, round-panicked cock's-foot, *Dactylis glomerata*, crested dog's-tail, *Cynosurus cristatus*, woolly soft grass or Yorkshire bent, *Holcus lanatus*, annual meadow or Suffolk grass, *Poa annua*, fertile meadow grass, *Poa fertilis*, rough-stalked meadow grass, *Poa trivialis*, meadow fescue, *Festuca pratensis*, hard fescue, *Festuca duriuscula*, field brome, *Bromus arvensis*, florin, or large-leaved creeping bent, *Agrostis solonifera*, yellow oat-grass, *Avena flavescens*, Italian or annual rye-grass, *Lolium Italicum*, perennial rye-grass, *Lolium perenne*, and wood meadow grass, *Poa nemoralis*, are the valuable species. It has been justly and finely said, that the "peculiar characters of the grass, which adapt it especially for the service of man, are its apparent humility and cheerfulness; its humility, in that it seems created only for the lowest service—appointed to be trodden on and fed upon; its cheerfulness, in that it seems to exult under all kinds of violence and suffering. You roll it, and it is stronger the next day; you mow it, and it multiplies its shoots, as if it were grateful; you tread upon it, and it only sends up richer perfume. Spring comes, and it rejoices with

all the earth—glowing with variegated flame of flowers—waving in soft depth of fruitful strength. Winter comes, and, though it will not mock its fellow plants by growing then, it will not pine and mourn, and turn colourless or leafless as they. It is always green, and is only the brighter and gayer for the hoar-frost.”

Flowers of the field, the hedge-bank, and the woodland, objects of interest from their early appearance, beauty, or profusion, are conspicuous in the country stretching southward from the centre of Yorkshire to the shores of the Channel, where the most extensive vale lands occur. In this region, the common daisy, *Bellis perennis*, may be seen, with the first breathing of spring-time, whitening whole acres with its floral development, which the buttercup, *Ranunculus bulbosus*, changes to a hue of gold; while in some situations, as in the Trent valley near Nottingham, the meadow crocus, *Crocus vernus*, gives as prodigally a violet colour to the landscape, finely contrasting with the fresh and vivid green of the early grass. In moist and shaded places, the primrose, *Primula vulgaris*, modestly puts forth its bloom, so beautifully pure; the violet, *Viola odorata*, “loveliest herald of the spring,” half hid by its broad green leaves, betrays itself by its odour to the rambler; the wood anemone, *Anemone nemorosa*, shows its white and star-shaped blossoms; the daffodil, *Pseudo-narcissus*, in watered meadows and damp copses, boldly exhibits its golden urns; the blue “eyebright,” *Veronica chamaedrys*, appears beneath the hedges; the mezerion, *Daphne mezereum*, displays its purple clusters while the plant is leafless; the yellow cowslip, *Primula veris*, nods to the breeze on fertile soil; and the dandelion, *Leontodon taraxacum*, “sunflower of the spring,” peeps out betimes from withered leaves, dry stalks, and deso-

lation, to tell us that the winter is past, and the time for the singing of birds is come. Every child knows the latter plant; and its commonness may detract from its interest. But the form of the flower, with its ligulate petals, many times doubled, is elegant and perfect; the liveliness and warmth of its golden colour is not exceeded by that of any other plant; and the succeeding head of down, which, loosened from its receptacle, floats upon the breeze, freighted with a seed at its base, to germinate in a new site, seems more like an operation of animal than vegetable existence. The word dandelion is a corruption of *dent de lion*, the French translation of the botanical name. It is one of our most correct dial flowers, closing at five o'clock in the afternoon, and opening again at seven in the morning.

Indications of time and of meteorological changes are afforded by many of our flowering plants. The beautiful purple sandwort, *Arenaria rubra*, expands to the sunshine, and closes as the curtains of the night are drawn, or before a coming shower. The corollas of the germander speedwell, "eyebright," are all securely shut at the approach of rain, and they as surely open when it ceases.

" Not for thy azure tint, though bright,
Nor form so elegantly light,
I single thee, thou lovely flower,
From others of the sylvan bower—
Thy name alone is like a spell,
And whispers love in 'Speed thee Well.' "

The tiny but brilliant flowers of the pimpernel, *Anagallis arvensis*, commonly called the poor man's weather-glass, close many hours before the occurrence of rain, and also go to sleep, or close, soon after twelve, again expanding at seven in the morning. Another plant, the

goat's-beard, *Tragopogon pratensis*, has obtained the name of "John, go to bed at noon," from its early closing. The flowers of the red campion, *Lychnis diurna*, open in the morning; and those of the white campion, *Lychnis respertina*, expand themselves towards the approach of night. The wood sorrel, *Oxalis acetosella*, an unobtrusive, elegant little inhabitant of the moist, shaded bank, shuts up its curious triple leaves, and hangs its flower towards the earth, as night approaches.

"Flowers, shrinking from the chilly night,
Droop and shut up, but with fair morning's touch
Rise on their stems all open and upright."

The great white ox-eye, *Chrysanthemum leucanthemum*, foretelling the coming storm, closes its flowers.

Among the striking or useful *marsh* and *aquatic* plants, we have the marsh marigold, *Caltha palustris*, enlivening the streams in the early year with its yellow bloom; several species of pond-weed, *Potamogeton*, raising their delicate green flowers above the water, while the whole of the foliage is immersed; the yellow iris or flag-sedge, *Iris pseudacorus*; the water scorpion grass, *Myosotis palustris*; the tall bulrush, *Scirpus lacustris*, the stems of which are used for mats and chairs; the sweet flag, *Acorus calamus*, strewn over the floors in the days when carpets were unknown; the flowering rush, *Butomus umbellatus*, the loveliest of the tribe; the tall and conspicuous hemp agrimony, *Eupatorium cannabinum*, often five feet high; the grass of Parnassus, *Parnassia palustris*, plentiful in Scotland; the great cat's tail, or reed-mace, *Typha latifolia*, the downy seeds of which are used as a substitute for feathers; the water violet, or feather foil, *Hottonia*

palustris, rare in some counties; the white water-lily, *Nymphaea alba*, "Naiad of the river;" the yellow water-lily, *Nuphar lutea*, a common attendant; the graceful meadow-sweet, *Spiraea ulmaria*, by the side of streams; the wholesome water-cress, *Nasturtium officinale*, found in most secluded brooks; and the ivy-leaved bell-flower, *Wahlenbergia hederacea*, a beautiful but little known trailing plant, growing in situations where few persons have the opportunity of becoming acquainted with it, over the mossy surface of damp and peaty bogs.

" Over the font's damp, mossy stones they grew
Luxuriantly,
 Those little bells of faint and tender blue,
Which gracefully
 Bent their small heads in every breeze which stray'd
 From lawny sunshine to the woodland's shade."

Our *maritime* plants—those which have their habitat on the sea-shore, or by the side of salt-water creeks—not a numerous or striking class—include the thrift, *Statice armeria*, often called sea-turf, which adorns with its white or pink tufts the crevices of the rocky cliff; the sea-lavender, *Statice limonium*, showing a spike of blue lilac flowers; the tall sea-holly, *Eryngium maritimum*, stiff and rigid, with beautifully veined pale green leaves; the horned poppy, *Glaucium luteum*, decked with frail yellow petals; the saltwort, *Salicornia herbacea*, very general, used in making glass and as a pickle; the sea-sandwort, *Arenaria peploides*, sea-convolvulus, *Calystegia soldanella*, and sea-beet, *Beta maritima*; the marsh mallow, *Althaea officinalis*, celebrated for its healing properties; the Michaelmas daisy, *Aster tripolium*, or blue cannonile; and the samphire, *Critheum maritimum*, well-known as a pickle, limited

to the south coast of England. The latter plant is of a fleshy substance, with small greenish-white flowers, branched and jointed stems. It grows upon the steep face of the rocks, which renders the gathering of it an employment of no inconsiderable danger.

“ Half-way down
Hangs one that gathers samphire, dreadful trade!
Methinks he seems no bigger than his head.”

Though a plant of the coast, it never grows so near the sea as to be washed by the waves. The name is probably a corruption of the French “*herbe de St. Pierre*.”

The wisest of men, a sovereign, “spake of trees, from the cedar-tree that is in Lebanon even unto the hyssop that springeth out of the wall;” and in all stations of life, botanical knowledge, like every species of information, is a valuable acquisition, and may unexpectedly prove highly useful to its possessor. So far from a little learning being a dangerous thing, it has only to be correct as far as it goes in order to be an important gain. A ship having been wrecked off Beachy Head, four of the crew were thrown by the violence of the waves upon a ledge of rock at its base, and succeeded in effecting a lodgment upon it. The night was dark and tempestuous; and the tide was rising. It soon became apparent to the unfortunate men that the advancing billows would probably render their position untenable; yet to escape from it seemed impossible. The cliff was too perpendicular to be scaled; and, as the waves dashed higher and higher, the forlorn hope was embraced of casting themselves upon the ocean, which perchance might bear them to a more favourable part of the shore. At this moment, one of the party,

to secure his footing, clung to a weed, which a flash of lightning enabled him to recognise as a sprig of sulphure. He knew that the plant, though closely approaching the sea-mark, has its site above it. The mariners consequently determined to remain on the ledge; the tide soon began to ebb; and at daylight they were released from their distressing position by the people of the neighbourhood.

In the class of *dangerous* plants, we possess several species, some of which are highly ornamental; and many fatalities would have been prevented by knowledge of their botanical characters and properties. In general, it may be remarked that the vegetable juices which are noxious or deadly when carelessly received into the system are medicinal when properly administered; while many berries which are destructive to human life are the food of birds. The one-seeded berries of the mezereon are highly poisonous to man; but the thrush and the blackbird find them palatable and nourishing, and seek after them with eagerness. The tall and showy fox-glove, *Digitalis purpurea*, one of the handsomest of our native flowers, contains a virulent poison, which, scientifically treated, becomes a valuable medicine; and, in a similar manner, the dangerous narcotic properties found in the thorn apple, *Datura stramonium*, and the henbane, *Hyoscyamus niger*, give sleep to the sufferer under skilful direction. The monkshood, wolfsbane, or aconite, *Aconitum napellus*, our most poisonous herb, is also an important medicinal agent. Though frequently found in a wild state, it appears to have been originally introduced from other countries, and disseminated in early times from the gardens attached to the religious houses. From this circumstance, as well as from the singular hoodlike

form of the upper part of the flower, it acquired the familiar name of monkshood ; but aconite is the ancient and classical name. It has been largely associated with crime ; for the Roman stepmothers are said to have employed it to poison their step-children ; and in our own country it has been a frequent cause of death, owing to the resemblance of the roots to those of horse-radish, leading to their substitution. During the year 1855, at a dinner-party at Dingwall, in the north of Scotland, this inadvertence was fatal to two Roman Catholic priests and a private gentleman. In a similar case at Bristol, it was ascertained by Mr. Herapath, the analytical chemist, that death had been caused by aconitine not exceeding five one-hundredths of a grain in weight. Consequently, the poison of the aconite is the most deadly known, not even excepting prussic acid. Its roots may readily be distinguished from those of the horse-radish by the scrapings rapidly assuming a pinkish brown colour on exposure to the air. The whole order to which the aconite belongs consists of poisonous plants, and includes the buttercup of our meadows, the Christmas rose, the larkspur, and other familiar flowers. But the deleterious properties are comparatively slightly developed.

Of the *nettle* tribe, so annoying to childhood in its rambles, we have three species, the young tops of which are sometimes boiled and eaten by the country people—the small nettle, *Urtica urens*, common on crumbling walls, the sides of cliffs, and at their base ; the great nettle, *Urtica dioica*, abundant in ditches, hedges, and by every way-side ; and the Roman nettle, *Urtica pilulifera*, the most virulent in its sting, confined chiefly to the south-eastern maritime districts.

Few of our wild plants are more generally attractive

than those of the *climbing* and *twining* class, with which the close of summer graces the hedges and copses, interweaving their slender boughs with stronger stems, unable to sustain the weight of their numerous leaves, flowers, or berries. It is singular, that some of these twining plants follow the apparent course of the sun, twisting from left to right; while others turn round the supporting stem contrary to the sun, or from right to left. The tendency proper to each species is invariably maintained by every individual; and cannot be altered without the plant eventually perishing. The common white bryony, *Bryonia dioica*, covers the hedges with its vine-shaped leaves and round red berries; the sweet-scented convolvulus, *Convolvulus arvensis*, hangs its pink bells on the wheat-stalk; the larger bindweed, *Calystegia sepium*, with its pure white bells, called by the country people "Old man's nightcap," festoons the bushes; and the traveller's joy, *Clematis vitalba*,

" Name well bestowed
On that wild plant which, by the road
Of southern England, to adorn
Falls not the hedge of prickly thorn,"

often extends itself more than twenty feet from its root. The climbing tendency and vertical direction, so strongly characteristic of vegetable nature, remarkably displays the wisdom and benignity of Providence; for the ascending position of the greater number of plants is evidently essential to their growth, and to the welfare of man and of the lower animals. Had the horizontal direction been followed, profuse vegetation would be in a great degree a curse instead of a blessing. Under such an arrangement, the surface of the earth, clogged with stems and foliage, would be an impassable shrubby wilderness, which the want of a free circulation of air, promoting

vegetable decay, would soon convert into a vast pestiferous region, altogether incompatible with the higher forms of animal life.

Fragrant and richly beautiful is the flora of our *moors, downs, and chases*. The sweet gale, *Myrica gale*, like the myrtle in appearance and odour, plentiful on Dartmoor, in Wales, and in Scotland, is gathered to perfume linen-chests, and strewed with the heather for the nightly couch of mountaineers; and the highest flavoured venison is said to be furnished by the deer that browse upon the heath-land where the wild thyme, *Thymus serpyllum*, grows in the greatest profusion. Such localities are empurpled in summer with the common heaths, *Erica cinerea* and *Erica tetralix*, used for thatch and bedding, of which genus the whole of America does not contain a single example, and are golden with the myriad flowers of the "bonnie broom," *Genista scoparia*, from which the bees gather a rich harvest of honey. But the evergreen furze or gorse, with its countless yellow blossoms, is the greatest ornament of the hill-lands and commons, where the cottager's donkey is turned adrift to feed, and his merry children play. The common gorse, *Ulex Europæus*, however unheeded by us, is always an object of admiration to foreigners. Linnæus fell upon his knees when first he beheld it, and thanked God for its loveliness, enthusiastically lamenting that his own country, Sweden, was destitute of such a treasure. Though hardy, he tried in vain to naturalize it; but it has been taken to St. Helena, and now blooms profusely there over the arid and barren rocks. The dwarf furze, *Ulex nanus*, a smaller shrub, and not so general, is of greater interest, as it flowers only in the autumnal and winter months.

The *floral emblems* of the three kingdoms, the *rose*

of England, the *thistle* of Scotland, and the *shamrock* of Ireland, must not be overlooked. We have several wild species of our national flower, as the common dog rose, *Rosa canina*, with its scarlet hips in the hedges, a favourite food with the birds, supposed to betoken a severe winter when unusually abundant; the sweet brier rose, *Rosa rubiginosa*, or eglantine, distinguished from the former by its smaller flowers, deeper pink, and fragrant leaves; the burnet-leaved rose, *Rosa spinosissima*, bearing slightly cream-coloured flowers, chiefly found on chalky or sandy soils; and the trailing dog rose, *Rosa arvensis*, reputed to be the white rose of the Yorkists. The Scotch national emblem is the cotton thistle, *Onopordum acanthium*, distinguished by the hard spines of the leaves. It is said to have been adopted from the circumstance that, when about to be surprised at night by an invading party of Danes, one of them placed his naked foot upon the plant, and uttered a cry of pain, which roused the Scots to a sense of their danger. Other species are the milk thistle, *Carduus marianus*, so called from the milky white streaks on its leaves; the musk thistle, *Carduus nutans*, with bright purple and fragrant blossoms; and the carline thistle, *Carlina vulgaris*, frequent on dry pastures, bearing yellow flowers. The shamrock is the Irish name for a three-leaved plant, by means of which, according to tradition, St. Patrick illustrated the doctrine of the Trinity, when he landed in 433 to convert the natives. But it is doubtful whether the common wood-sorrel, or a species of white clover, is the plant really entitled to the name.

A country remarkable for its moist atmosphere and clouded sky, where the summer-temperature is rarely excessive, is ill adapted for the spontaneous growth of

fruits; and, accordingly, the catalogue of our native arborescent, shrubby, and herbaceous fruit plants is sufficiently meagre. The crab or wild apple, *Pyrus malus*, is found in many districts, rising to the height of a considerable tree; and before the introduction of modern methods of obtaining vegetable acids, its sour juice was in considerable request under the name of verjuice. A wild cherry, *Prunus cerasus*, bearing fruit of the small black kind, is ranked by Evelyn among "the forest berry-bearing trees, frequent in the hedges, and growing wild in Herefordshire and many places," and may be regarded as indigenous, being found in some situations among the mountains of Scotland where it is difficult to imagine it to have been carried. The wild plum, or bullace, *Prunus domestica*, growing in the hedges, may possibly have found its way there from some of the cultivated sorts, and have degenerated; but the sloe, or black-thorn, *Prunus spinosa*, is undoubtedly a native, a plum in a state of nature. Its leaves are commonly supposed to be used in the adulteration of tea; and its berries enter largely into the composition of what is called port-wine. The well known hazel-nut, *Corylus avellana*, is common in copses on the banks of ravines and dingles, occupying extensive tracts of the more northerly and mountainous parts of the country; and the rapidly-growing elder is equally familiar, the berries of which are fermented into wine reputed to be medicinal. Boerhaave, the celebrated physician, is said to have frequently taken off his hat upon passing this tree, in honour of its medicinal virtues. The bramble or blackberry is among the best, as it is the most abundant of our native berries, producing an excellent fruit in a dry and sunny autumn, acceptable and useful to the rural poor. The strawberry and raspberry, with the

bilberry, cranberry, and cloudberry, before mentioned, are also natives. Probably some kinds of gooseberries and currants cultivated in gardens are derived from indigenous species, as they are very apt to spring up in the woods and hedges from seeds carried there.

Turning to the woodlands, the following are the principal *timber trees* which are generally acknowledged to be of British origin, or at least to have been naturalized from the remotest antiquity :—

Alder.	Hawthorn.	Pine, or Scotch Fir.
Ash.	Holly.	Poplar.
Beech.	Maple.	Willow.
Birch.	Mountain Ash.	Yew.
Elm.	Oak.	

Natural forests originally clothed a very considerable part of the surface of Great Britain and Ireland. They were largely felled and fired by successive invaders to deprive the inhabitants of refuge, while constantly increasing havoc was made with them by an increasing people for fuel, and the vast variety of purposes to which timber is applied. As population also advanced, more land was required for culture ; and the woods were subjected to the axe to make room for regular tillage. A similar clearance has marked the progress of man in all woody countries, and is extensively going on at present in Canada. Seventy-seven forests were once enumerated in England as belonging to the crown. They were successively disafforested till the number was reduced to eleven ; and these are now in process of reduction. Only six have any important extent, the New Forest, in the south-west of Hampshire, 66,942 acres ; Dean Forest, between the river Severn and the Wye, 23,015 acres ; Woolmer Forest, in the south-east of Hampshire, 5,945 acres ; Whittlebury Forest, in the south-east of Northamptonshire, 5,424 acres ; Windsor Forest, Berks, 4,402

acres; and Delamere Forest, Cheshire, 3,847. But of the total area of 109,575 acres, only about 30,000 are actually occupied with timber.

The Alder, *Alnus glutinosa*, distinguished by its sombre foliage and glutinous leaves, seldom attains any considerable size. It thrives best in damp situations, loves the water-side, and grows very luxuriantly on the banks of the Mole in Surrey, adding great beauty to the scenery around Dorking and Esher. The timber of one of the varieties is known as Scotch mahogany in the north, being red and finely streaked, and is made into household furniture.

The Ash, of which the species are very numerous, is, next to the oak, the most valuable of our trees, and one of the most beautiful while clothed with its light green foliage. But the leaves, late in expanding, fall with the first frosts of autumn; and the tree becomes as unsightly as it has been ornamental, from the contrast which the desolated boughs offer to the richly variegated colouring of the autumnal woods. The common ash, *Fraxinus excelsior*, is sometimes called "the husbandman's tree," owing to the greater number of agricultural implements being made of the timber, and the use of the branches for stakes, poles, and wood-fencing. It grows rapidly, rises higher than the oak, and often attains very large dimensions. Dr. Plot mentions one with a diameter of eight feet; Mr. Marsham another with a girth of seventeen feet; but the monster example, in Woburn Park, is twenty-three feet six inches in circumference on the ground, rises ninety feet, and is estimated to contain in the stem, arms, and branches 872 feet of timber. The weeping-ash is a variety, possessing all the characters of the common ash, except that its branches grow downward.

The Beech, *Fagus sylvatica*, is regarded by some as an exotic, owing to the statement of Cæsar that he did not meet with it in Britain. But it must be remembered that he penetrated only a little way into the island, stayed but a short time, and had his attention too much occupied with military movements to be an exact botanical observer; while it is not at all unlikely that the *fagus* of the Romans may have been either the Italian oak or the chestnut. Whether originally a native or not, the beech has been in the country from times prior to the commencement of its written or traditional history. It is most abundant on the chalk lands of the south of England, where it forms forests of great magnificence and beauty. The Burnham Beeches, near Maidenhead, often visited by parties from the metropolis, where the axe of the woodman has not been heard, are fine examples of forest scenery, and of the majesty of untended nature. Beech-wood is largely employed in making furniture, tools, and sleepers for railways; the small timber forms excellent fuel; the leaves were once extensively used as a substitute for feathers in a bed; and the mast or fruit is eaten by swine. The tree, though not so ornamental as several others, is conspicuous for its beautiful autumnal hues.

The Birch, *Betula alba*, distinguished from all other forest-trees by the silvery whiteness of its outer bark, is also the most elegant and graceful of the woodland family, and highly useful to the inhabitants of all northern countries. Yet, though poetically styled "the lady of the woods," it is the reverse of being feminine in its habits, requiring no rich soil or sheltered situation in which to flourish, but growing where the cold bites hardest and storms are wildest, and reaching a higher elevation than any other of our indigenous trees. It is

found in Scotland at an altitude of 3,500 feet, and is very adorning to its mountain scenery. The variety called the weeping-birch, from its long pendulous branches, is general in Scotland and in Wales.

The common Elm, *Ulmus campestris*, the first of our large forest trees to meet the spring, putting forth innumerable dark purple blossoms, followed by the young green leaves, is eminently English; for our Saxon forefathers loved to overshadow their homesteads with its branches; and hence the many names of places in Domesday-book still extant of which the word "elm" is a component. The tree attains stately proportions, and lives long. One cut down at Chelsea in 1745, said to have been planted by Queen Elizabeth, was thirteen feet in circumference at the ground, and 110 feet high. Another, near the Boddington oak, in the vale of Gloucester, was, in 1783, about eighty feet high, and the smallest girth of the principal trunk was sixteen feet. The superb avenue of the "Long Walk" in Windsor Park consists partly of elms planted at the beginning of the last century. Though now past their prime, instances are on record of leaves having been put forth for more than three centuries. The mountain, Scotch, or *wych-elm*, *Ulmus montana*, has larger leaves, differently shaped, than the common English species.

The Hawthorn, white-thorn, or May-bush, *Cratægus oxyacantha*,

"The milk-white thorn that scents the evening gale,"

associated with rural festivities, though commonly used as a hedge shrub and kept low, becomes a tree of no inconsiderable size if suffered to grow. In old parks which have been left in their natural state, it may frequently be seen, with a gnarled trunk eight or nine

feet in girth. It grows very rapidly at first, and just as slowly after having attained some size, remaining apparently unaltered during the lifetime of a generation. "When the traveller, or the man of the world, after a life spent in other pursuits, returns to the village of his nativity, the old hawthorn is the only playfellow of his boyhood that has not changed. His seniors are in the grave; his contemporaries are scattered; the hearths at which he found a welcome are in the possession of those who know him not; the roads are altered; the houses rebuilt; and the common trees have grown out of his knowledge; but be it half a century or more, if man spare the old hawthorn, it is just the same—not a limb, hardly a twig, has altered from the picture that memory traces of his early years."

The Holly, *Ilex aquifolium*, is likewise generally trained as a hedge-plant, but attains the height of fifty or sixty feet when the natural growth is not interfered with; and the Maple, *Acer campestre*, is also most commonly met with in the hedge-rows. Though bearing part of the name of the common ash, the Mountain Ash, *Pyrus aucuparia*, is a wholly distinct tree, of far inferior size, but a most beautiful object on the hills of the north, where its light green foliage, white flowers, and bright red berries, agreeably contrast with the solemn gloom of the dark pines. In the days of superstition and folly, it was celebrated for its power of averting the influence of the "evil eye" and witchcraft in general, and hence arose its popular name of the witch-tree.

The monarch of the woods, "the unwedgeable and gnarled Oak," is one of the most majestic of trees in its prime, standing up firmly against the blast, and yielding the best of all timber, in point of strength, durability,

and applicability, while it is a strikingly picturesque object in its decay,

" Dry and dead,
Still clad with reliques of its trophies old,
Lifting to heaven its aged, hoary head,
Whose foot on earth hath got but feeble hold."

There are two distinct species in England, the common oak, *Quercus robur*, the most esteemed and abundant, and the *Quercus sessiliflora*, supposed to have been imported from the continent some centuries ago, yielding an inferior timber, and distinguished by the longer leaves of the acorn-stalk. The tree has been called the "father of ships," from the extensive use made of it in naval architecture, for perhaps ninety-nine out of every hundred oaks are devoted to ship-building purposes. But there was a period in our history when it was chiefly valued for its acorns, upon which swine were fattened in the forests. This was one of the privileges of which the Norman sovereigns deprived the people, in order to preserve the beasts of the chase from intrusion, and gratify their passion for hunting—a grievance which Magna Charta redressed. The oak attains its prime in threescore years and ten, but lives to a far advanced age, continuing to vegetate long after the core has decayed, and the trunk been reduced to a complete shell. Numerous examples are on record of oaks remarkable for longevity, size, and historical associations. The King's Oak in Windsor Forest is supposed to be above 1,000 years old. The trunk, twenty-six feet in girth at three feet from the ground, is quite hollow. "We supped in it," says Professor Burnet, "September 2, 1829; it would accommodate at least twenty persons with standing room; and ten or twelve might sit down comfortably to dinner." Damory's Oak, near

Blandford in Dorsetshire, is one of the largest of which mention is made. It measured sixty-eight feet in circumference at the base. As this immense trunk decayed, it became hollow, and formed a cavity fifteen feet in diameter and seventeen feet high. During the time of the Commonwealth, it was inhabited by an old man, and used as an ale-house. The dreadful storm of November, 1703, reduced the tree to a ruin; but its last vestiges, when sold for firewood in 1755, realized £14. The Saley Forest Oak, in Northamptonshire, estimated at from 1,000 to 1,500 years old, is forty-seven feet in circuit, a fine vegetable ruin, still producing an annual crop of leaves and acorns.

The Pine or Scotch Fir, *Pinus sylvestris*, a kind of national tree in Scotland, like the oak in England, is generally diffused in Europe, Asia, and America. Its natural character is best developed in exposed and bleak situations, amid mountains, crags, and waterfalls.

"Moor'd in the lifted rock,
Proof to the tempest's shock,
Firmer he roots him the ruder it blows."

It claims a high place among valuable trees, and is eminently the "builder's timber," being largely used in the construction of dwelling-houses. In very early ages, great part of Britain, the south as well as the north, was covered with pine forests, remains of which are found in the Highlands. Of their former existence in England, the most complete proof was afforded during the draining of Hatfield Chase in Yorkshire, in the reign of Charles I., when a vast multitude of the roots and trunks of pines, oaks, birches, and other trees, of all sizes, were found embedded deep in the swampy soil. At least a third of the trees were pines, some of which were thirty yards and upwards in length, and were sold

for masts of ships. The roots were, for the most part, standing in their natural position in the soil, with their proper trunks prostrate by their side. Many bore marks of having been burned; some were chopped and squared; and others were half-split, with large wooden wedges and stones in them, and broken axe-heads, somewhat like sacrificing axes in shape. Several coins of the Roman emperors, exceedingly worn and defaced by time, were discovered near a large root, in the parish of Hatfield. There can be no doubt that the Romans destroyed the forest, partly by cutting down the trees and partly by burning them, when the prostrate trunks so interfered with the natural drainage as to cause water to accumulate, finally producing, by the propagation of mosses, a peat-bog, which speedily covered up the timber.

Of Poplars, the small-leaved white poplar, *Populus canescens*, and the large-leaved one, or abele, *Populus alba*, rank with the native trees, but are more ornamental than useful. Of the numerous Willow family, the most common indigenous species are the white willow, *Salix alba*, growing to a large size by the margin of rivers, and presenting a fine appearance when the wind turns up the silvery sides of its leaves, and the osier, *Salix viminalis*, abundant in most fenny places, generally cut down for basket-work before it becomes an arborescent. The coracles, or boats of the ancient Britons, light and buoyant, were probably made of basket-work of willow, covered with the skins of animals. Specimens of their skill in this kind of manufacture were known and esteemed at Rome. The Yew, *Taxus*, formerly plentiful in each of the three kingdoms, but now comparatively rare, is of great repute in our military and superstitious history. Owing to the compact,

hard, and elastic character of the wood, it was in high request for bows, when the word of command on the battle-field was,

“ Draw, archers, draw your arrows to the head ; ”

and, the tree being accounted sacred, it was commonly planted in churchyards, while its branches were carried over the dead on their passage to the grave, and thrown beneath their coffins. The yew often attains very great dimensions, and survives to a venerable age. The trunk of one found by Pennant in the churchyard of Fortingal, in Perthshire, completely hollow, and bearing only a few leaves at one point, was fifty-six feet and a half in circumference, or eighteen feet in diameter. The yews at Fountains Abbey, in Yorkshire, were trees of considerable dimensions when the abbey was founded, in 1132, as the monks resided beneath their shelter during the time of its erection. The Aukewyke yew, within sight of which Magna Charta was signed, is supposed to be upwards of a thousand years old. There are other examples, still fresh and green, whose age is greater than the ruined buildings by the side of which they have stood apparently unaltered for many centuries.

A few of the more prominent or common introduced *foreign trees* may be noticed. The Chestnut, *Fagus castanea*, brought out of Asia by the Greeks, and transported into Italy by the Romans, rapidly spread over most parts of Europe, and was known in Britain at an early period. It appears from a deed of gift granted in the reign of Henry II. by the Earl of Hereford to Flexley Abbey, that chestnuts were tithed as producing a fruit of value. Old and very large trees have been mentioned in England, Ireland, and Scotland, occurring as far north as Ross-shire. Grose found one of four

chestnuts in Cranford Park, Dorset, thirty-seven feet in circuit, still bearing good crops of fruit, though shattered and decayed. In Gloucestershire, there was another, in the hollow of which was "a pretty wainscoted room, enlightened with windows, and furnished with seats;" and the great chestnut at Fortworth, in the same county, had dimensions and a reputed age belonging to few English trees. In 1720, it measured fifty-one feet round at six feet from the ground; and, though tradition carries back its origin to the times of the Saxon Egbert, it bore fruit abundantly at the close of the last century. The Lime, *Tilia communis*, forming aisle-like avenues in parks, and common in towns, was imported from the continent, probably in the early part of the sixteenth century. It is the "carver's tree," so called from the adaptation of the timber to be wrought with tools. The exquisite carvings with which Gibbons adorned so many churches, palaces, and mansions in the reign of Charles II., are of lime-wood. The Walnut, *Juglans regia*, the "cabinet-maker's tree" in England, prior to the introduction of mahogany, came from the warmer parts of Europe, and was once much more abundant than at present, as great numbers of trees were cut down during the long war, the wood being employed for the stocks of all kinds of fire-arms. The Larch, *Pinus larix*, the most valuable perhaps of the coniferous family after the pine, was introduced from Switzerland as a rarity in the early part of the seventeenth century, and has been more largely and successfully planted, especially in Scotland, than any other foreign tree. It was preceded by the Norway Spruce Fir, *Pinus abies*, the loftiest of the pine tribe, furnishing masts for the largest ships, to which Milton alludes in his description of Satan:—

" His spear, to equal which the tallest pine
Hewn in Norwegian hills to be the mast
Of some great ammiral were but a wand."

The common Box, *Buxus sempervirens*, if not a native, has flourished in England from an early date, particularly in Surrey; the name of Boxhill commemorates their presence. The Cedar of Lebanon and the Weeping-Willow from the Levant; the Mulberry from Italy; the Laburnum from Austria; and the Lombardy Poplar from the valley of the Po, are other examples of exotics.

The vegetable world is prolific in wonders, declaring alike the wisdom and the power of Him at whose primeval command "the earth brought forth grass, and herb yielding seed after his kind, and the tree yielding fruit, whose seed was in itself;" * while the adaptation of this kingdom of nature to supply the wants of man finely illustrates the bounty of Providence. A profound impression of creative energy can hardly fail to be made upon the mind by that boundless diversity of form, colour, and qualities, displayed by the innumerable species of plants with which the earth is clothed; and the vast variety of situations in which they are enabled to flourish and propagate their kind—on the sands by the sea-shore, in the depth of valleys, and on the mountain's brow—challenges an admiration never so fitly expressed as in the words of inspiration:—"This also cometh forth from the Lord of hosts, which is wonderful in counsel, and excellent in working."† All manifestations of the Divine wisdom and power are specially grateful to the Christian, as intimating the all-sufficiency of a Being who has been pleased to come into communion with him through the Son of his love. They arm him against apprehension amid the dangers of the

* Genesis i. 12.

† Isaiah xxviii. 29.

present life, and when the solemnities of death approach; while they justify the largest expectations respecting that unknown range of Divine operation which the life that is to come will reveal. Beautiful in the flush of spring and the glow of summer are the trees of the forest and the flowers of the field. But a time comes when, the vital powers which produced and sustained the vegetation being withdrawn, the woods lose their foliage, the flowers pass away, and hill and dale are marked with a faded verdure. A period also arrives when the withdrawal is so complete and final that the giant oak is prostrated, after having braved the blasts and storms of centuries. Vegetable nature is thus a silent monitor of our own inevitable lot; and, while surveying its changes, we act wisely in reflecting upon the simple and true allusions so often made by the voice of inspiration to the leaf-like and flower-like frailty of our race. The reflection need not excite melancholy feeling, and will not do so, if it is rightly improved, leading us to "live by the faith of the Son of God, who loved us and gave himself for us."* The anticipation may then be confidently indulged, that when the body dies the soul will be dismissed to unutterable blessedness in His presence; while the body will rise again, changed and ennobled, to be for ever present with the Lord.

* Galatians ii. 20.

CHAPTER IX.

GENERAL ZOOLOGICAL FEATURES.

Extinct Animals—The Irish Elk—The Beaver, Bear, Wolf, and Wild Boar—Wild Cattle—Extinct Birds—British Zoologists—Invertebrated Animals—Phosphorescence of the Sea—Earthworm and Leech—Crustaceans—Minute Examples—Insectivorous Tribes—British Butterflies—Aggregation of Gnats—Mollusca—The Pearl Mussel—Vertebrated Animals—Fishes, Cartilaginous and Osseous—Salmon, Herring, Cod, and Carp—Families—Reptiles—Lizards, Batrachians, Snakes—Number of Birds—Birds of Prey—Perching Birds—Summer and Winter Visitors—Scraping Birds—Waders and Swimmers—St. Kilda—Mammalia—Hedgehog and Mole—Badger, Fox, Wild Cat, and Weasel—Squirrel, Hare, and Rabbit—Deer Tribe—Marine Mammalia.

THE cutting down of the forests, the cultivation of the soil, and the destructive effects of the chase, with the vast increase and diffusion of the population, have affected in no slight degree the fauna of the kingdom; extinguishing whole species within its bounds, restricting the range of others, and rendering individual examples of them exceedingly rare, while for purposes of food, luxury, and convenience, useful animals, domestic fowl, pond and river fish, have been introduced. In noticing briefly the *extinct races*, reference will alone be made to those whose former existence on our soil is established by historical testimony, or other evidence independent of fossil remains. In this class the *great elk* of Ireland has some claim to be placed, though it is but slender. Remains of the animal, one of the deer tribe, allied to the fallow deer, but vastly superior in size to any living representative of the race, are so common in the bogs that they have ceased to be regarded as curiosities. They are also found in the alluvial strata of the Isle of

Man, and of England; but the sister island seems to have been eminently the home of the animal. Owing to the enormous size of the antlers, it could not have inhabited the forests, but must have ranged the heathery hills and moors. In the "*Archæologia Britannica*," there is a letter of the Comtess of Moira, giving an account of a human body found in gravel under eleven feet of peat, soaked in the bog-water, in good preservation, and completely clothed in antique garments of hair, conjectured to be that of the departed elk. But more conclusive upon the point of the animal having been contemporary with man in the island is a rib in the museum of the Dublin Royal Society. The bone bears evident marks of having been struck by some sharp instrument, which remained long in the wound, but had not penetrated so deep as to destroy the creature's life. The mark is of that kind which the head of an arrow would produce. Beyond these circumstances, the history and fate of the stately ruminant are lost in the night of past ages.

In the class of *rodents*, Great Britain once numbered the interesting *beaver*, an animal associated in our minds with wondrous labours and social instincts. Giraldus Cambrensis, who travelled through Wales towards the close of the twelfth century, gives an account of its manners, and states that in his time it was only to be found in the river Tivy. But in far earlier times it must have been very scarce, for, by the laws of Howel the Good, the price of a skin was fixed at 120 pence, a great sum in his days. The Welsh called the beaver the broad-tailed animal. Two or three pools, called "*beaver-lakes*," preserve its memory in the principality. It was likewise a tenant of some of the English and Scotch rivers; and its bones have been found in various places

commingled with those of the wild boar, the deer, and the wolf. The name of Beverley, in Yorkshire, signifies the "place of beavers."

Various authorities witness to the ancient existence of the *bear* in the forests of our islands. The Roman poet Martial states that the Caledonian bears were employed to heighten the misery of the unhappy sufferers on the cross; and, according to Plutarch, bears were transported from Britain to Rome, where they were much admired. In old Welsh documents relating to hunting, the animal is reckoned one of the beasts of the chase, and its flesh is said to have been esteemed as much as that of the hare or boar. Many places in Wales still retain the name of Pennarth, the "bear's head." It is not known when the bear was extirpated in South Britain; but down to the time of the Norman conquest it infested Scotland, for in the year 1507 a Gordon was allowed by the king to carry three bears' heads upon his banner, as a reward for his valour in killing one. But of all beasts of prey in these islands the *wolf* was by far the most common and dangerous in the times of the Saxons and was so specially destructive to the flocks in the depth of winter that they distinguished the month of January by the name of *wolf-monath*. In Yorkshire, wolves so much abounded that, in the reign of King Athelstan, a retreat was built at Flixton, in that county, to which travellers might flee, in case of being hard pressed by a pack. Edgar, a succeeding sovereign, endeavoured to get rid of them by commuting the penalties attached to certain crimes into the delivery of a number of wolves tongues for each offender, while in Wales, he converted the tax of gold and silver into an annual tribute of three hundred wolves' heads. But these measures had no permanent

effect, for some centuries afterwards, in the reign of Edward I., the crown interposed to superintend and assist in the destruction of wolves in the counties of Gloucester, Worcester, Hereford, Stafford, and Salop. In Derbyshire, certain persons held their lands by the duty of hunting and destroying the animal. The wolf was probably soon afterwards extirpated in England. But at so late a date as the year 1680 the last was killed in Scotland by Sir Ewen Cameron of Lochiel, while the race lingered in Ireland till about the year 1710, when the last perished in the county of Cork.

The *wild boar*, from which all the varieties of the domestic hog are supposed to have sprung, was another occupant of the woods, and was stringently protected by the laws of the Norman sovereigns as a favourite animal of chase. In their time, a vast forest extended on the north side of London, which abounded with the wild boar, the stag, and the roebuck; and those who were convicted of killing any one of them, in this or any other of the afforested lands, were liable to be barbarously punished with the loss of their eyes. A few examples of the wild boar remained in the New Forest, Hampshire, down to the reign of Charles I.; and there is now a domesticated breed, which, left to run wild for generations in its glades, has reverted in some degree to the original type.

The *Urus*, commonly called the *wild ox*, but of a different species from domesticated cattle, existed in considerable numbers in the woodlands of England and Scotland, from the time of Cæsar to the middle ages, and has left its bones in the peat-mosses, marshes, and beds of sand. The Roman general describes it as being "not much inferior to the elephant in size, and though resembling the common bull in colour, form, and gene-

ral aspect, yet as differing from all the domestic cattle in its gigantic size, and especially in the superior expanse and strength of its horns." This formidable race of oxen roamed in the forests close to London in the time of the first Plantagenet, as appears from the testimony of Fitz-Stephen, a monkish chronicler of that age, who mentions them under the name of *ari sylvestres*. Six wild bulls are enumerated among the provisions at the great feast of Nevil, archbishop of York, in the reign of Edward iv. The horns of the Dun Cow, killed by the redoubtable Guy, earl of Warwick, now exhibited as a trophy in Warwick castle, belonged to one of these animals. Breeds of wild cattle are still extant in a few parks, as at Chartley, in Staffordshire, and Chillingham castle, in Northumberland, which were formerly supposed to be deteriorated descendants of the ancient urus. But this opinion has been generally abandoned. It is not unlikely that, in the early and oft troubled times of the country, domesticated breeds may have been driven from the farms to the woods, and have propagated a wild race, which the advance of civilization gradually extirpated, with the exception of a few allowed to remain in the parks of the nobility. The Chillingham cattle, with which those at Chartley closely correspond, are probably a remnant of this stock. They are very beautiful in form, of a white colour, with the inside of the ears red or brown, and the eyes, eyelashes, and tips of the horns black. They are fierce when pressed, but generally speaking timid, bounding off to a kind of sanctuary in the wood upon the slightest disturbance. Like the red deer, they take advantage of the irregularities of the ground, so as to hide themselves from observation. In advancing, the bulls lead the van, the rest following in single file; and in

retreating the bulls bring up the rear. Their cry is peculiar, more like that of a wild beast than of ordinary cattle.

Several species of *birds* have been greatly reduced in numbers by the sportsman and the fowler; some have wholly disappeared; and many, once extensively distributed, are only to be met with in retired localities. Since the days of the Plantagenets and Tudors, man has established his habitation in many a dell then abandoned to the splash of the torrent, and on many a heath rarely visited by a human footstep, scaring away the *eagle* and *kite* from their old haunts, while *aquatics* have been compelled to shift their residence to obtain food, by the conversion of fens and marshes into cultivated fields. The *Capercaillie*, or cock of the woods, a splendid bird of the grouse tribe, attaining the size of a turkey, once bred in the pine forests of Britain and Ireland, but has been extirpated. It was not uncommon in Strathspey at the commencement of the last century, and a specimen was seen in the year 1760 in the woods of Strathglass. Attempts have recently been made to re-establish the bird on the estates of some of the Scottish nobility, by the importation of pairs from Norway. It remains for time to show whether the experiment will succeed or prove a failure. Another, and still larger game bird, the *Great Bustard*, has long been extinct in Scotland and Ireland, where perhaps it was never common; and only a few examples can remain in England, if there be a single survivor. Pennant states that in his time, 1777, these birds inhabited most of the open country of the south and east parts of the island, from Dorsetshire up to the wolds of Yorkshire, and were generally found in flocks of fifty or more. Newmarket

Heath and Salisbury Plain were favourite haunts. The bird was last seen on an estate in Norfolk.

Notices of extinct species might be multiplied by referring to the departments of Entomology; but our limited space renders it imperative to pass to the *actual zoology* of the kingdom.

The author of the work entitled "The Wisdom of God in Creation," published in 1690—**JOHN RAY**, F.R.S., born of parents of humble rank in Essex, in 1627—was the first intelligent investigator of animated nature, in relation to his native country, and may be called the father of natural history, as the founder of true principles of classification, both in zoology and botany. He was not more distinguished by scientific attainments than by his benevolence, integrity, and religious spirit; and properly, in honour of an illustrious countryman, an association recently established for publishing valuable natural history works has called itself the Ray Society. Thousands of subsequent labourers in the same field have been profoundly impressed with the truth of his remark:—"There is a greater depth of art and skill in the structure of the meanest insect than thou art able for to fathom or comprehend." About the same period, **LISTER** illustrated the extensive order of the molluscous animals, with an admirable perception of natural affinities, considering the time in which he wrote. Soon after the middle of the last century, **JOHN ELLIS**, a merchant of London, devoted his leisure to the study of the zoophytes, and established the true position of these singular creatures as members of the animal kingdom, instead of being partly of a vegetable nature, as their name, "animal-plants," denotes. At that date, the Rev. **GILBERT WHITE** was making those

observations in the fields of his Hampshire parish, and the garden of his rectory, which now form the "Natural History of Selborne," one of the most fascinating books of its class in the language. In our own time, KIRBY and SPENCE have specially connected their names with British Entomology; MACGILLIVRAY with the birds; YARRELL with the fishes and birds; Professor BELL with the crustaceans, reptiles, and quadrupeds; Professor FORBES with the star-fishes and naked-eyed medusæ; Dr. JOHNSON with the zoophytes; SMITH with the diatomaceæ; and THOMPSON with the general fauna of Ireland. Among numerous other illustrators of our zoology, Mr. C. W. PEACH may be mentioned, who attained to the honour of a discoverer while in a humble position, engaged in onerous duties. In the year 1841, he was a subordinate in the Cornish coast-guard, the school-master of his own family, and the superintendent of the Sunday-school in the village of Goran Haven, where he resided. During his solitary journeys along the beach, he cast an observant eye upon the forms of nature in his path, and was the first to describe a radiated animal, bearing the singular local name of the "nigger" from its dark colour, and the "cotton-spinner" from its long white threads, which he reported at the York Meeting of the British Association, in 1844.

INVERTEBRATED ANIMALS.

The group of *radiated animals*, so called from the limbs or arms branching from a common centre, comprise the infusory animalecules, internal parasites, zoophytes or corallines, and the true radiata, as star-fishes, in which the peculiar structure is very apparent. Though

the lowest forms of life, they are objects adapted not only to please the fancy and inform the understanding, but to give fresh and unexpected views of the ways of Him whose glory is not less displayed in the construction of an atom than in the creation of central suns and planetary worlds. While small in many examples, so as to be invisible, they are organized existences, and maintain the continuance of their species by Providential care, thus revealing to us that magnitude is nothing in the sight of God, who is pleased to frame and to regard the minute and weak as benignly and as attentively as the mighty and the massive. The phosphorescence of the ocean, most frequently seen in tropical latitudes, but often observed with brilliance in our own seas, arises from the presence of innumerable little living inhabitants of this order in the waters, especially the medusæ, or jelly-fish, *Noctiluca meliaria*, endowed with the power of emitting a beautiful phosphorescent light. The luminosity is not constant, but appears when agitation of any kind disturbs the microscopic tenants of the surface of the deep. "A passing breeze, as it sweeps over the bosom of the sea, will cull from the waves a flash of brilliancy which may be traced for miles; the wake of a ship is marked by a long track of splendour; the oars of your boat are raised dripping with living diamonds; and if a little of the water be taken up in the palm of the hand, and slightly agitated, luminous points are perceptibly diffused through it." The Cornish fisherman is often enabled, by the phosphorescence of the water, to see his net to its full depth like a brilliant lace-work of fire; but at the same time the snare is thereby revealed to the pilchards, and avoided by their passing to the right or left.

The second primary group in the animal kingdom,

following the ascending scale, consists of the *articulated* or *jointed* races, and includes the annelids, crustaceans, and insect tribes. Earthworms and leeches are the common representatives of the first class, to which the term *annulus*, a little ring, is applied, from the bodies being composed of a multitude of rings. Despised, trodden underfoot, and apparently despicable as is the earth-worm, its loss would be the abstraction of an important link from the chain of nature. Besides supporting half the birds and some quadrupeds, it promotes vegetation by perforating and loosening the soil, rendering it pervious to rain, air, and the fibres of plants, while the mould of pasture lands is rendered fine by passing through these creatures. The horse-leech is found in ponds and ditches in almost all parts of the country; and the more important medicinal leech, *Hirudo medicinalis*, is also a native of Britain, but not indigenous to Ireland. It was employed in the rude surgery of our forefathers, who applied the "leech," derived from the Anglo-Saxon verb *lece*, to cure, to all persons, male or female, who were skilled in the healing art. In an old ballad, a princess is thus denominated by her father :

" Come down, come down, my daughter deare,
Thou art a leech of skille."

The native leech is now very rare, and will probably soon become extinct. Though still found in the lakes of Cumberland, it is there rapidly disappearing. Wordsworth makes his "leech-gatherer" say :

" Once I could meet with them on every side,
But they have dwindled long by slow decay ;
Yet still I persevere, and find them where I may."

The supply for surgical purposes forms an important article of foreign commerce, many millions being annually imported from Holland and other countries.

Crustaceans are distributed round all our coasts—crabs, lobsters, shrimps, and prawns—some occupying the sandy, and others the rocky shores, while cray-fish inhabit the rivers. Notwithstanding the enormous consumption of these creatures for human food, an undiminished supply is maintained owing to the extraordinary fecundity of the races. The spider-crab, so called from its length of legs, produces at one laying more than 76,000 eggs. The small edible crab, eaten by the poor, has its favourite station beneath stones or tangle, or half-concealed in the moist sand; but the larger species are caught from deep water, in baited willow baskets resembling mouse-traps, generally by the aged, who are not capable of the more laborious duties of fishermen. They sometimes reach the weight of 14 lbs. at Falmouth, and very commonly weigh 9 lbs. in the London market. Lobsters, more domestic in their habits, never go far from their birth-place; and hence the discovery of a colony is a certain source of profit, yielding an uninterrupted return for years, as the females lay eggs by the 50,000. In the season, from March to August, not fewer than 150,000 are sent to Billingsgate from different parts of the coast of England, Scotland, and the Channel islands, while the supply from Norway amounts to 600,000. Minute crustaceans, not distinguishable separately by the naked eye, are found both in our fresh waters and seas in such prodigious numbers as to have a discolouring effect. They are known by the name of Entomostraca, intended to express the fact of their being insects in a shell, and are the most dignified in zoological position, while complicated in structure, of all the creatures found in drops of water, which are magnified for the benefit of sight-seers at our exhibitions. Mr. Goodsir, one of the ill-fated party

under Sir John Franklin, has stated that, during the summer months, in the firth of Forth, great masses of animal matter abound on the surface of the sea, which the fishermen have long noticed and familiarly call *maigre*. On examining this matter, in the neighbourhood of the island of May, he found it to consist mainly of these organisms, upon which cetaceous animals and fishes, porpoises, dolphins, cod, and herrings, were preying. In the estuaries, these minute animals are the principal food of the salmon; and the trout of Loch Leven is supposed to owe its superior quality to the fact of its chiefly feeding upon them. An observer who carefully watched the hatching and increase of one fresh-water species supposed, as a moderate estimate, the female to lay eight times within three months, and each time only forty eggs. At the end of one year, this female would have been the progenitor of 1,112,189,120 young.

The *Entomology* of the kingdom embraces upwards of 10,000 species, which are known to naturalists, and have been described by them. Of this number, somewhat more than a third, or 3,850 species, range to Ireland. The distribution of insects being regulated in a great measure by vegetation, certain classes are restricted to districts where woods abound and aquatic plants, or where a peculiar flora prevails. Thus the entomology of the south-east of England is intimately connected with the presence of the chalk plants in that region. Detail cannot be indulged in relation to a subject so vast as our insect tribes.

The *sheath-winged* order, *Coleoptera*, includes the various beetles, some of which are carnivorous in their habits, and remarkable for the brilliant metallic lustre

of the armour that encases them. A diminutive variety has caused many a stout heart to beat with apprehension, for in the days of superstition its call was vulgarly supposed to betoken death.

“ The solemn death-watch click'd the hour she died.”

The sound, exactly like the tick of a watch, is simply the call of the insect for its companion. To this order the interesting glow-worm belongs, which is common on heaths and moors in the south of England, but not known in Ireland. Of the straight-winged class, *Orthoptera*, the familiar representative is the cricket of the hearth, popularly considered, from its chirp, an emblem of cheerfulness, so pleasingly described by Cowper:

“ Thou surpassest, happier far,
Happiest grasshoppers that are ;
Their is but a summer's song,
Thine endures the winter long.
Unimpair'd, and shrill, and clear,
Melody throughout the year.”

Grasshoppers and locusts belong to the same division. Of the latter, which occur in prodigious swarms in eastern countries, desolating the fields, gardens, and woods, we have only a few harmless wanderers. The May-flies of the angler, and the splendid dragon-flies seen on the sides of streams and ponds, flitting among aquatic plants or soaring over the water in quest of their prey, are common examples of the nerve-winged insects, *Neuroptera*, both of which pass the beginning of their existence in the water. Tribes eminently social, forming large and well-regulated communities, as ants, wasps, and bees, are comprised in the membranous-winged order, *Hymenoptera*, but are too well known to require remark. We have species solitary in their habits, as the sand-wasp and the carpenter-bee.

Of the scale-winged order, *Lepidoptera*, comprehending butterflies and moths, nearly 2,000 species are British, 150 of which extend to Ireland. The vast majority are moths, distinguished as nocturnal, flying by night, and crepuscular, referring to the hawk-moths, which are most active as the day closes and breaks, or during the twilight. The number of our butterflies amounts to only about seventy, some of the most splendid of which are not found in Ireland; and are either rare or extremely local in England. Thus the swallow-tail, *Papilio machaon*, the largest species, and one of the most beautiful, is almost unknown away from the fens of Lincolnshire, and is there becoming more scarce owing to the abridgment of the swampy districts by drainage. The Camberwell beauty, *Vanessa antiopa*, named after the metropolitan suburb where it was first noticed, the crowning glory of the tribe, is now exceedingly rare, though scarcely a year passes without a specimen or two being seen or taken. In some years, as 1789 and 1819, it has been numerous in many parts of the kingdom. The Scotch Argus, *Hipparchia blandina*, chiefly occurs in the south of Scotland; and the Arran Argus, *Hipparchia Ligea*, has not been observed out of that island. More generally diffused species of the splendid kind are the peacock butterfly, *Vanessa Io*; the red admiral, *Vanessa Atalanta*; and the purple emperor, *Apatura Iris*. The latter is the most magnificent of common examples, haunting oak woods in the southern and central counties of England. Of all the wonders of the animal kingdom, the metamorphosis exhibited by the butterfly is one of the most marvellous—at first a crawling and voracious worm, then a torpid being enveloped like a mummy in a case, and next a gaily adorned, agile, and aerial creature, roving through the summer

air from flower to flower, graceful in every movement, the delight of children and the admiration of manhood. But this natural change is not more certain and surprising than the spiritual transformation by which human beings are made "new creatures in Christ Jesus," or that future material improvement which the word of inspiration reveals to all believers, when "this corruptible shall put on incorruption, and this mortal shall put on immortality."

The remaining divisions of the insect world embrace minute half-winged species, *Hemiptera*, deforming and injurious to vegetation, black upon the woodbine, green upon the rose, and cottony upon the apple-tree, familiarly called "blight;" various two-winged families, *Diptera*, forming the innumerable host of midges, flies, and gnats, some of which are intensely annoying to cattle in the heat of summer; and the tribes of spiders, *Arachnidae*, which are proportionably numerous as the flies upon which they prey abound. The tendency to congregate, dance in the sunshine, and accompany the traveller on his journey, is remarkably displayed by insects of the dipterous class; and occasionally they appear locally in such extraordinary numbers as to attract universal attention. In the year 1736, the common gnat rose in the air from Salisbury Cathedral in columns so much resembling smoke that many of the inhabitants of the town thought the building was on fire. A similar instance of more recent date is recorded in the history of Norwich. At Oxford, in 1766, six columns were observed a little before sunset, some perpendicular, and others oblique, attaining the height of fifty or sixty feet. The phenomenon was still more conspicuously displayed in the vicinity of Belfast towards the midsummer of 1842. "The insects appeared in

columns above the trees, the shade of colour varying, according to the greater or less density of the mass, from that of light vapour to black smoke, the columns not only differing in this respect from each other, but each column being frequently different in different parts. They might have been mistaken for dark smoke-wreaths but for their general uniformity of breadth, and for a graceful and easy undulation, similar to that of the tail of a boy's kite, when at some height and tolerably steady. The individual insects flew about in each column in a confused and whirling multitude, without presenting in their mazy dance any of those regular figures which gnats frequently exhibit over pools of water, while the motion of their wings filled the air with a peculiar and not unmelodious humming noise. The columns rose perpendicularly to the height of from thirty to sixty feet, and in some instances to the height of eighty feet. They were equally abundant over trees of every kind; and so numerous were these distinct columns that so many as from 200 to 300 were visible at the same time." The cause of these aggregations of the gnats is one of the unsolved problems of natural history.

Soft-bodied animals, *Mollusca*, mostly provided with shells, form the third and last great group of the invertebrata. They are found in the pastures and gardens, in pools, lakes, and rivers; but the most important species are marine, some being moored to the rocks, while others are endowed with the power of locomotion. The shells of our shores, though incomparably inferior in size and beauty to those which are obtained from tropical seas, are highly ornamental in several examples, while the mollusca, commonly called shell-fish—limpets, whelks, or periwinkles, cockles, mussels, and oysters—

are of great value as articles of food. In times of dearth, the Irish and Scotch peasantry have migrated to the coasts, and sustained themselves for weeks chiefly upon the shell-fish there met with. British oysters have been celebrated from a remote antiquity. In the time of the Roman dominion, they were sent to the banks of the Tiber, being highly prized by the epicures of the capital, who are said to have been able to tell from what quarter they came, simply by the taste. A regular fishery was carried on for this purpose, as well as to obtain the pearls and mother of pearl occasionally found within the shell of a large-sized mussel, *Aricula margaritacea*. At a recent date, pearls of value have been fished from the estuaries of the rivers, one of which, taken from the Conway, was presented to the queen of Charles II., and honoured with a place in the regal crown. But, the majority being small and ill-coloured, a fishery would not pay its expenses. A singular use is made of the common mussel, *Mytilus edulis*, at Bideford, a town in Devonshire, where a long bridge of twenty-four arches crosses the Towridge river. At this bridge the tide flows so rapidly that the structure cannot be kept in repair by mortar. The corporation, therefore, keep boats in employ to bring mussels to it, and the interstices are filled by hand with them. It is supported from being driven away by the tide entirely by the strong threads these mussels fix to the stonework; and by an act or grant, it is a crime liable to transportation for any person to remove the shell-fish, unless in the presence and with the consent of the corporate trustees.

VERTEBRATED ANIMALS.

The more highly organized beings which compose

this grand division of the animal kingdom consist of *Fishes, Reptiles, Birds, and Mammalia*, or Quadrupeds.

Fishes.—The fishes in the seas, rivers, and lakes of Great Britain and Ireland, figured and described by Mr. Yarrell, amount to 263 species; but several of the oceanic examples are not constant and characteristic residents, but only occasional visitants from northern or southern ichthyological provinces. The *Cartilaginous* group, or those in which the skeleton is never completely ossified, is represented by the sturgeon, *Acipenser sturio*. This fish is most frequently caught in the estuaries, and is considered a royal fish when captured in the Thames within the jurisdiction of the Lord Mayor, because, by ancient custom, it was sent to the table of the sovereign. One taken in the Severn, in 1802, weighed 190 lbs.; another caught in Scotland, in 1833, measured eight feet and a half in length, and weighed 203 lbs.; but Pennant mentions one, captured in the Esk, which weighed 164 lbs. The rays or skates, used as food, and the dog-fishes, so troublesome to fishermen, belong to the same group with the sharks, which are summer visitors to the Channel. The blue shark, *Carcharias glaucus*, remarkable for the slenderness of its body, and celebrated for its affection for its young, is an inhabitant of the Mediterranean, but arrives on the coast of Cornwall about the middle of June, and is sometimes so abundant, that eleven have been taken by a single boat in one day. Another species, the porbeagle, *Lamna cornubia*, is also common, especially when the shoals of mackerel are unusually large. On fine evenings, these rapacious creatures have been seen close in shore, skinning along the surface of the water, a large triangular dark coloured dorsal fin being the

only part visible. The eel-like fishes, or sea lampreys, *Petromyzon marinus*, which periodically ascend the Severn and other rivers to deposit their ova, are likewise cartilaginous, with the lamperns or river lampreys, *Petromyzon fluviatilis*, which permanently inhabit our streams. The illness which proved fatal to Henry 1. is said to have been brought on by a dish of lampreys, of which he was very fond.

Of the vast group of *osseous* fishes, or those which have a long skeleton, only the more important, which contribute to the support of man, will be noticed. The salmon, *Salmo salar*, the acknowledged head of a valuable tribe, is abundantly found in the Scotch and Irish rivers, to which it migrates from the sea in autumn for the purpose of spawning, returning to it again in the early spring. In obedience to this instinct, the fish vigorously pushes its way up rapids, and makes extraordinary leaps from the water to overcome falls, sometimes throwing itself out of the streams, and perishing on the banks. It is said that at the falls of Kilmerae, in Inverness-shire, the Frazers of Lovat occasionally amused their guests at the expense of the salmon. Placing a kettle on a rock close to the edge of the water, it was kept boiling, and the company waited till some unlucky assailant of the waterfall missed its aim, and fell into the pot. Other members of the same family are, the salmon-trout, *Salmo trutta*, most abundant in the Scotch rivers; the common trout, *Salmo fario*, diffused in rapid streams and clear lakes; the great lake trout, *Salmo ferox*, sometimes exceeding a yard in length, and thirty pounds in weight, caught in the Scotch lochs and Irish loughs; the char, *Salmo umbla*, plentiful in the lakes of Cumberland; the pollan, called also the fresh-water herring, *Coregonus*

pollan, found in Loughs Derg, Erne, and Neagh; the smelt, *Osmerus eperlanus*, a migrant from the sea to the rivers on the east and west coasts, but not known in the Channel; and the grayling, *Thymallus vulgaris*, local in some gravelly English and Welsh streams, not in Scotch or Irish.

The herring, *Clupea harengus*, periodically migrates in vast shoals between deep water and our shores, coming to the coast for the specific purpose of developing its young by the increased temperature. Though found on all parts of the coast, the fishery is chiefly carried on along the east side of the island, from Yarmouth northwards to Wick, and is an object of national importance. The herring perishes so instantaneously on being taken out of the water, that the phrase "dead as a herring" has become proverbial. Belonging to the same tribe, we have the pilchard, *Clupea pilchardus*, a visitor in prodigious numbers from the deep ocean to the coast of Cornwall and Devon, as well as to the south of Ireland; the sprat, *Clupea sprattus*, taken principally in winter along the shores of Kent, Essex, and Suffolk; and the white-bait, *Clupea alba*, a summer migrant to the brackish water of the Thames.

The common cod, *Morhua vulgaris*, ranges round all the coasts, but is most plentiful about the islands on the north and west of Scotland, the west of Ireland, and between the Thames and the Lincolnshire coast. It is the head of a family containing many species yielding our population an abundant supply of food, as the haddock, the whiting, the hake, and the ling. Mackerel, *Scomber scomber*, one of our most useful and beautiful fishes, a member of another tribe, while very general, is most largely caught in the Channel and on the coast of Suffolk. Flat fish are represented by the well-known sole,

the plaice, the flounder, and the turbot. Eels of three species inhabit the ponds, streams, and lakes, migrating to the estuaries to deposit spawn, when in favourable circumstances for a "run." The conger eel, occasionally of immense size, is marine.

The carp family includes the minnow, gudgeon, bream, bleak, tench, barbel, and other familiar freshwater fishes, with the gold and silver fishes originally imported from China. Though abundant, and completely naturalized, the carp itself, *Cyprinus carpio*, is not a native, but was introduced at an early date. In the "Boke of St. Albans," printed at Westminster in 1496, the record occurs: "The carpe is a daintous fische, but there ben but fewe in Englonde." It was probably imported by the Normans, but is supposed not to have been known in Ireland prior to the seventeenth century, while rare in Scotland at present. The perch, *Perca fluvialis*, bold and voracious, one of the best of our river fishes, represents a different race, to which the striped red mullet of the south coast belongs. The pike, *Esox lucius*, common in sluggish streams and still waters, strong, active, and rapacious, is probably not a native, for its value was formerly rated higher than that of the salmon, and ten times greater than that of the cod or the turbot. In the reign of Henry VIII., a large pike sold for double the price of a house lamb in February, and a small one for more than a fat capon. The fish has the reputation of being long-lived, and sometimes attains an immense size, specimens taken in the Irish and Scotch lakes weighing from fifty to seventy pounds.

Reptiles.—In the class of reptiles our islands are very fortunate, for we have but thirteen species, of

which only five are common to Ireland. They are all innocuous, with one exception, while some are manifestly useful. The list includes two lizards, two frogs, two toads, four newts, and three serpents. The rare occurrence of the hawk's-bill and coriaceous turtles, drifted across the Atlantic to various parts of our western shores by the waves and currents, entitles them to no place among British reptiles.

The sand lizard, *Lacerta agilis*, named after its haunt in the south of England, is oviparous, while the other species, *Zootica vivipara*, brings forth its young alive. The latter is the smallest and most widely diffused, extending to Scotland, and one of the few reptiles found in Ireland. The beautiful green lizard of the south of Europe has its northerly limit in the Channel islands. Of the amphibious reptiles, Ireland has the common frog, *Rana temporaria*, believed to have been introduced at the beginning of the last century; the Natter-jack toad, *Bufo calamita*, found in parts of the counties of Cork and Kerry; and two of the newts, only one of which is general, the common smooth eft of Great Britain, *Lissotriton punctatus*. The absence of the common toad, *Bufo vulgaris*, and all the snakes from the sister island, is ascribed by popular tradition to St. Patrick, who banished "the varmint" by a malediction. No animal has been more unjustly maligned than the toad; and it is still viewed in various quarters with peculiar abhorrence. Formerly it was considered highly poisonous, not only from its bite, but its look and breath. The "poisonous hunch-backed toad"—"venomed toads"—"loathsome as a toad"—are phrases applied to it in our popular literature. But in reality the reptile is perfectly harmless, and also useful in the economy of nature, preying upon the grubs and insects

that are injurious to field and garden produce. Hence it is not uncommon for floriculturists and gardeners to introduce it to their beds. The singular error was once prevalent with which Shakspeare has connected a profound moral truth :

“ Sweet are uses of adversity ;
Which, like the toad, ugly and venomous,
Wears yet a precious jewel in his head.”

Lupton, in his First Booke of Notable Things, bears repeated testimony to the virtues of this jewel, and, after direction how to procure it, gravely remarks : “ You shall knowe whether the tode-stone be the ryght and perfect stone or not. Hoble the stone before a tode, so that he may see it ; and if it be a ryght and true stone, the tode will leape towards it, and make as though he woulde snatch it. He envieth so much that man should have that stone.” It does not appear how this fantastic notion originated ; but the above extract shows it to have been current in the age of queen Elizabeth. The popular opinions which the progress of natural philosophy has shown to be erroneous form a long list.

The blind-worm or the slow-worm, *Anguis fragilis*, one of our snakes, usually about a foot long, is found in various parts of England and Scotland, but is of rare occurrence. Its common names refer to the smallness of the eyes and slow locomotion, while the Linnæan, “the fragile snake,” alludes to the ease with which it may be cut in two by the blow of a slight rod. It is quite inoffensive and timid, though once reputed to be venomous. The viper, or adder, *Pelias berus*, the only animal we have whose bite is poisonous, occupies sandy wastes and dry heaths, and is very generally distributed

in Great Britain. Though the wound is painful, and produces high inflammation, Professor Bell states that he never saw a case, or could trace the report of one to an authentic source, which terminated fatally. The common ringed snake, *Natrix torquata*, harmless and timorous, is frequent in moist woods and damp meadows, but is much better known in England than in Scotland. Though an inhabitant of the land, it readily takes to the water, swimming with facility, and has been seen crossing even an arm of the sea on the coast of Wales. The usual length is from three to four feet ; but a monster example was found dead upon a farm in the neighbourhood of Colchester in 1855. It measured nine feet five inches long, and was eleven inches in girth at the thickest part. The snake had evidently been trying to force its way beneath the lower bar of a gate which was off its hinges ; and it was killed by the gate falling upon its head and neck. Many persons in the swampy locality recollected having been startled by seeing something like a great snake rustling in the brushwood and plunging into a pond of water.

Birds.—The catalogue of our native birds, excluding domesticated breeds and accidental stragglers, numbers about 274 species, of which 230 are known in Ireland. This is a very large proportion, considering the limited area of the kingdom, for the total number of species in the whole of Europe is estimated at 490. But, besides being rich in species, individual examples are numerous. Both facts are connected with the verdant and woody character of the country, vegetation supporting insectivorous tribes, while insects sustain birds ; and with its insular position, which invites the aquatic races to the shores. Macculloch remarks, writing before the age of

railroads, that, while travelling from Calais to Paris, a journey of a day and a half, he did not see, "at the very most, more than twenty birds, including two or three crows, and about as many hawks; while, if there had been more, there was scarcely a tree, a thicket, or a hedge to shelter them. On the other hand, let any one traverse the same extent of country in Britain, along our thick-hedged and often shady roads, and we question not but that he will count twenty species of birds in a single hour." Observers have noted the following numbers of species within narrow areas :

	Nearly
Kensington Gardens, London	70
Site near Belfast, seventy-five acres in extent	70
SeBorne Parish, thirty miles in circuit	120
Same circuit around Belfast, chiefly maritime	185

While in general very plainly attired, many of our feathered tribes are remarkably melodious songsters.

The golden eagle leads the van of our *birds of prey*, *Raptors*. It is remarkable for power of vision, swiftness of flight, and audacity in the pursuit of prey, often carrying off from the field the game which sportsmen and dogs are pursuing. Though occasionally taken in England, it chiefly haunts the mountainous districts of Scotland, with those of the west and north of Ireland. So amply are the eaglets provided by the old birds with food, such as hares and rabbits, that well-authenticated instances are on record of peasant families being sustained for a time by the pillage of a single nest. The white-tailed, or cinereous sea eagle, is a species of smaller size, and much more abundant, delighting in rocky coasts. Other predatory tribes are represented by the rare gyr falcon, the peregrine falcon, the merlin, and the kestrel; the scarce goshawk and the generally diffused

sparrow-hawk; the kite, rare in England, and not known in Ireland as an indigenous bird; with the hen-harriers, scouring rick-yards at eventide to catch rats, and the common buzzard, a tenant of the woodlands. In former times, the peregrine falcon was highly valued on account of its docility, and was therefore principally used for the purpose of hawking. Though the clifly coast is its proper habitation, it roams inland, and has been known to visit Westminster Abbey, with some of the metropolitan churches, in order to prey upon the tame pigeons in their neighbourhood. Of the owls, nocturnal birds of prey, the most general species is the white or barn owl, which takes up its abode in the "ivy mantled tower," and old unoccupied buildings of any description, moving abroad at dusk with such an inaudible movement of the wings, that the flakes of snow scarcely descend more silently through the air. Owing to their strange appearance, and discordant screams, these birds were deemed of evil omen in ignorant and superstitious times.

"Yesterday, the bird of night did sit,
Even at noonday, upon the market-place,
Hooting and shrieking."

But they are simply useful guardians of the fields, which they ransack with the pertinacity of dogs, clearing them of rats and mice.

The order of *perching birds*, *Insectores*, or those which are distinguished by the habit of perching, in connexion with peculiarities in the form of the bill, comprehends upwards of a hundred of our species, many of which migrate periodically. Among the permanent residents several are justly prized for their rich or pleasing minstrelsy, as the thrush, blackbird, skylark, wood-lark, linnet, goldfinch, bullfinch, water-

ouzel, redbreast, wren, and hedge-sparrow, while others possess the power of imitating the human voice in a high degree of perfection, as the raven, magpie, jackdaw, and jay. They are all at the same time very generally distributed through the three kingdoms; but the magpie has only been established in Ireland since the commencement of the sixteenth century. A singular habit belongs to the water-ouzel. The bird, one of the thrush family, frequents upland streams, and is not only a well-known diver, but appears to be able to walk underneath the water. Mr. St. John expressly states, that he has seen the ouzel go down deliberately into a stream, and run about on the gravel at the bottom, scratching among the small stones in search of insects and animalcules. In point of beauty, the kingfisher, a constant sojourner with us, has no rival among British birds; and few of those in tropical countries surpass it in brilliant plumage. Living upon small fish and aquatic insects, it haunts the streams in almost all parts of the country, but is nowhere numerous. Of the widely diffused crow family, the chough, a red-legged species, is limited to secluded nooks and desolate headlands of the coast. Though once very common in Cornwall, it is now rare, as, owing to the high price put upon the bird by collectors, it has been mercilessly pursued by the peasantry.

The periodical *migrants* of this group are either summer or winter visitors, the former coming from the south and the latter from the north. They are hence distinguished as *equatorial* or *polar* birds of passage. Some of the summer guests range over the whole kingdom, as the cuckoo and the swallow tribe, while the two splendid warblers, the blackcap and the nightingale, are more local. The nightingale does not visit Scotland, Ireland, or Wales,

nor is it known in Cornwall, the west of Devon, or further north in England than the neighbourhood of York. Its notes are heard chiefly in the south-eastern counties, in the copses and groves of deep humid valleys and verdant parks. The males appear towards the close of April, preceding the females by about a fortnight, and quit the country towards the close of August. The swallow usually arrives by the middle of April, having been preceded by the sand-martin, and is followed by the house-martin and the swift. They come from the west and north of Africa. The most beautiful migrant, the golden oriole, is only an occasional guest, and is confined to the south of England and Ireland. Of the winter visitors, the fieldfare, a species of thrush, is the most common. It arrives from the north in large flocks in October, and remains, if the weather is open, until April, but passes on to more southerly countries if the season is severe. Though by migrating birds escape inclement weather and scarcity of food, it is impossible to refer the migration to these evils, because it takes place before they have been experienced. All that we know upon the subject is, that by an instinct directly implanted in their constitution by the Most High, "the stork in the heaven knoweth her appointed times; and the turtle and the crane and the swallow observe the time of their coming." Christians may ever consolingly reflect upon the express warrant which the Saviour gave to his disciples to regard the Divine care of the humbler orders in the creation, as a foundation for confidence respecting the extension of that care to themselves. "How much more are ye better than the fowls?"

The tribe of *scraping birds*, *Rasores*, of which the habit of scratching the ground in search of food dis-

tinguishes them, includes the breeds living in a domesticated state and wild species, of which we have the wood-pigeon, rock-dove, and turtle-dove, the latter a summer visitant, with the principal game birds, as the quail, pheasant, partridge, and grouse. The black grouse is found on moors in England and Scotland, but is not in Ireland; the red grouse occurs in each division of the kingdom, but not in any other part of the world; the white grouse or ptarmigan is limited to the highest and wildest of the Scotch mountains. The pheasant is not a native, but has long been naturalized. It came originally into Europe from the Caucasian isthmus, between the Black Sea and the Caspian. The common partridge is indigenous, but not the red-legged species, which was introduced into Suffolk from the continent, about the year 1790.

The *wading birds*, *Grallatores*, a numerous class, are represented in our ornithology by the plovers and peewits, the snipes, curlews, and sandpipers, the heron and bittern, the land and water-rail, the coot, water-hen, and woodcock. The land-rail, commonly called the "corn-crake," from its peculiar cry in the corn-fields, is a summer visitor, while the snipe and woodcock are winter guests, though a small number of both are permanent residents. The long-necked heron is the most striking bird we have of this order, whether seen on the wing, or standing motionless in shallow waters intently watching for its prey. The birds form colonies like the rooks, building their nests in the upper branches of high trees, and keeping to the same site from generation to generation. There are between thirty and forty heronries in the English counties, chiefly in parks.

The order of *swimming birds*, *Natatores*, is very extensive as to species and multitudinous as to individuals,

owing to the great range of our seaboard, the vast expanse of ocean around us, and the number of small rocky and solitary islets to serve the purpose of breeding stations. Wild ducks, geese, and swans, teal and widgeon, guillemots, puffins, cormorants, gulls, petrels, kittiwakes, and auks, are leading members of the group, and form one of the principal means of support to the inhabitants of our smaller islands. Some are winter visitors only, as the great northern diver, the wary bean goose, and the hooper or whistling swan, so termed in contradistinction to the mute domesticated species. The eider duck, which yields the prized eider-down of commerce, descends to the coast of Northumberland in winter, but is permanent in only a few of our most northerly localities. The gannet, or solan goose, has a singular distribution, restricting itself chiefly to six breeding places—Lundy Island, in the Bristol channel; one of the Skelligs rocks, off the coast of Kerry; Ailsa craig, in the firth of Clyde; the Bass rock, in the firth of Forth; Souliskerry, near the Orkneys; and St. Kilda. We take leave of the feathered races with a reference to the latter locality, the great metropolis of our sea-fowl, quoting the words of Macgillivray, a visitor in 1840: "Far below me could be seen the long heavy swell rolling in from the Atlantic and climbing up the dark rock, whose base it clothed with sheets of snow-white foam, as it broke with a sound at times scarcely perceptible, but at intervals falling upon the ear like distant thunder. In many places the rock was scarcely visible on account of the absolute myriads of sea-birds sitting upon their nests; the air was also literally filled with them, and the water seemed profusely dotted with the larger fowl, the smaller ones being nearly invisible on account of the distance. The sound of their wings

as they flew past, joined to their harsh screams as they wheeled along the face of the cliff, startled me from the reverie into which I was thrown by the strange scene before me. Every little ledge was thickly covered with kittiwakes, auks, and guillemots; all the grassy spots were tenanted by the fulmar, and honeycombed by myriads of puffins; while close to the water, on the wet rocks which were hollowed out into deep caves, sat clusters of cormorants, erect and motionless, like so many unclean spirits guarding the entrance of some gloomy cavern." The fulmar, one of the petrels, a highly valued bird, has no breeding-place in our islands besides St. Kilda.

Mammalia.—Omitting the domestic animals, the terrestrial and marine mammalia of our islands comprise about sixty species, of which not less than eighteen are bats, *Cheiroptera*. These twilight and nocturnal ramblers, however interesting to the naturalist, have little to invite the attention of the general reader, and may be dismissed with the remark, that, while some of the number are extremely rare and local in England, three only are known to occur in Ireland. *Insect-eating animals*, *Insectivora*, are represented by the hedgehog, the mole, and three species of shrew, a little creature, commonly called "shrew mouse," from resembling in size and aspect the mouse, but quite distinct in its character and habits. The hedgehog, remarkable for its defensive covering of spines, occurs in almost every part of Great Britain and Ireland, frequenting woods, copses, orchards, and thick hedgerows, though it is not abundant, having been cruelly persecuted by the ignorant and brutal. The mole is not found in any part of Ireland, nor at the north extremity of Scotland, but is very common in

England. Though popularly spoken of as the "blind mole," it has a limited power of vision, little being needed in its almost entirely subterranean existence; but the senses of hearing and smell are very acute.

Of *flesh-eating animals*, *Carnivora*, we possess the badger, fox, and wild cat, with five of the weasel family, the otter, and four seals. The badger, belonging to the bear tribe, is the only surviving member of it in the country; and is now very scarce, having been hunted and baited for a thousand years. The full grown animal is about as large as a middle-sized dog, but stands much lower. From the colour, it is often locally called the "grey." Solitary in its habits, the most secret recesses of the woods are its dwelling-places, where it sleeps all day in a burrow, moving abroad at night to prey upon insects, reptiles, and the eggs and young of the birds that build upon the ground. The fox, a sly depredator, is very general, having had the strange fortune of being inveterately hunted down by the hounds of the sportsman, and carefully preserved for his recreation. Long ago would the animal have been exterminated, but for the excitement furnished by its chase. The wild cat, probably extinct in England, lingers in the woods of Wales and Ireland, and is somewhat common in the forests of Scotland. Of the weasel family, the common weasel, stoat, and polecat are general, while the beech martin and pine martin are chiefly found in the northern woods. They are all remarkable for slenderness and flexibility of the body, an audacious and blood-thirsty disposition, and would be far more formidable than lions and tigers were they as large and powerful. The otter, feeding upon fish, is frequent in the streams of Wales and Scotland, but is marine in its habits in our northerly localities. The seal abounds on the western

and northern shores of Scotland, in the Orkneys and Shetlands, where numbers are annually captured with nets and shot for the sake of their skins and oil.

Our *gnawing animals*, *Rodentia*, consist of the families of the rat and mouse; voles of three species, popularly identified with the mouse, but more allied in several points to the beaver, none of which are in Ireland; the squirrel, the hare of two species, and the rabbit. The squirrel, an active and elegant animal inhabiting the woods, has also the merit of being provident in laying up a store of food for winter consumption. It is only known in Ireland as having been recently introduced from England, chiefly to the county of Wicklow; but there is a tradition that it was common there, before the destruction of the native woods. The English hare, one of the "beastis of venerye" to our chase-loving ancestors, is specifically different from the Irish hare, which is identical with the Alpine hare, occurring in the northern parts of Scotland, and occasionally seen on the mountains of Cumberland. Wild and timid as the hare is, it is susceptible of domestication, of which a well known instance was afforded by the poet Cowper. The allied rabbit, general and numerous, is not a native; but the date of its introduction has escaped notice. In the year 1309, at the installation feast of the abbot of St. Austin's, 600 rabbits were furnished, at the then great cost of 15*l.*, or sixpence each, the price at that time of a pig. The comparative frequency of some of the animals named appears from a record of the numbers killed on the estate of Culzean and Craighure moors, in Ayrshire, belonging to the Marquis of Ailsa. The noble owner offered a reward to his keepers for the destruction of vermin; and from June the 25th, 1850, to November the 25th, 1854, nearly four years and a

half, there were destroyed—rats in woods and hedges, 12,586; foxes, 32; otters, 19; badger, 1; wild cats, 1,296; martins, 2; polecats, 43; stoats, 2,132; common weasels, 1,942; and hedgehogs, 1,093.

The order of *ruminating animals*, *Ruminantia*, is represented by three species of deer still inhabiting the soil; the beautiful fallow-deer, supposed by some to have been introduced, but more probably an ancient rover of the forests, now semi-domesticated in parks; the red-deer, or stag, a larger species, roaming in herds the solitudes of the Scottish mountains, in all the wildness of nature, and not quite extinct in retired localities in England and Ireland; and the roebuck, the smallest of the three, not known in Ireland, but still common in the wooded highlands of Scotland. The goat, running semi-wild in a few parts of Wales, belongs to this order, with the domestic breeds of sheep and oxen. *Mammalia* inhabiting our seas, *Cetacea*, consist chiefly of porpoises of several species, some of which appear about the northern islands, while others gambol in herds about the whole coast, and chase the small fish in the bays and estuaries. The dolphin is an occasional visitor; and scarcely a summer passes without the true whales cruising off the Orkneys and Shetlands, and sometimes wandering into the English or Irish waters.

In relation to the *animal kingdom*, we are most happily circumstanced. The schoolboy may fearlessly wander through the woods, tramp the moors, climb the hills, and swim the rivers—adventures which cannot be conducted over a large portion of the globe, without hazard of encountering some of the dread ministers of death. In contrast, too, with the position of our forefathers relative to the brute creation, we are highly favoured. Difficult as it is to realize the fact, it is never-

theless true, that where the peasant now whistles behind his team, and the train glides along the railway, the wolf once howled, the bear lurked, the boar roved, and the wild bull bellowed. In thus displacing and exterminating the beasts of prey—driving the ploughshare through their haunts, and pasturing useful flocks and herds in their retreats—man undoubtedly fulfils the scheme of Providence, for expressly has dominion been given him over “the beasts of the field, the fowls of the air, and the fish of the sea.” But this change, though a vast improvement, is a very low view of the difference between the past and present condition of Britain. Thankfully and truly it may be added, that while the useful has been largely substituted for the noxious in the vegetable and animal kingdoms—fens been converted into farms and the habitation of dragons into fruitful fields—a human population has been extended to the former waste places, in a great measure free from the ignorance and errors of their forefathers, industrious and intelligent, a goodly proportion of whom are not only verbally acquainted with the message of God’s mercy to a fallen world in Christ Jesus, but have been the happy recipients of it. Just in proportion as this class is enlarged will evil be averted, and Our Island Home be truly more and more a “delightful land,” whether the sun shines brightly upon its hills, the tempest lashes its waters, or the snow lies deep upon the soil.

CHAPTER X.

MODERN GEOLOGICAL CHANGES.

Degrading and Elevating Forces—Raised Beaches—Parallel Roads of Glen-Roy—Changes of the Coast-Line—Brighton, Rye, Dover—Goodwin Sands—Dunwich—Change at Norwich—Sheringham—Coast of Holderness—Ravenspur—Spurn Point—Kilnsea—Fall of the Church—Rate of Waste—Annual Loss of Land—Shoals of the Humber—Sunk Island—Sand Drifts—Example in Scotland—North Coast of Cornwall—Eccles, in Norfolk—Coast of Sligo—River Floods—Transporting Power of Water—Moray Floods—Changes on the Netley—Peat Mosses—Rapid Formation—Hatfield Chase—Preserving Property of Peat—Bursting of Mosses—Landslips—Action of the Atmosphere—Of Springs—Marley Hill—Axmouth Landslip—Conclusion.

THE solid parts of the surface of the globe are more or less in process of being modified in their aspect by various agencies, as the atmosphere and the waters, which are general and permanent in their operation, and by internal heat, which, in its potent exhibitions, is local and intermittent. These causes of superficial change are opposed to each other in their effects. The former tend to wear down the land, and diminish its extent by transferring its materials finally to the floor of the ocean, while the general effect of the latter is to raise the land in relation to the sea-level, and thus increase its volume. Hence they are classified as degrading and elevating forces, and might as properly be styled destructive and repairing, as it respects the earth's exposed hard crust. They mutually counteract each other; and thereby a kind of equilibrium is maintained between the water-floods and the dry ground. The temperature of our mines, uniformly increasing with the depth, bears dis-

tinet witness to the internal heat of the globe; but we are happily far apart from the districts where the subterranean fires blaze and smoke at the surface. Neither have we any experience of the connected phenomena of earthquakes, as they occur in many parts of the world, with such tremendous energy as to shake cities in a moment into ruins, entomb entire populations, and strikingly alter the features of the landscape. But igneous agency, besides being paroxysmal in its displays, is a gradually elevating power; and it is undoubted, that in countries where no such catastrophes have occurred as those referred to, within the knowledge of history or tradition, a slow upheaving movement is at present in progress. Thus, a great part of Norway and Sweden is rising above the sea at the rate of a few feet a century. This appears from measurements taken at various intervals of the height of landmarks on the coast. Beaches also occur considerably above the present high-water mark, containing deposits of marine silt, and the shells of mollusca now living in the Baltic; monuments these of the action of the same elevating force in by-gone times.

Similar beaches, lying beyond the present dash of the billows, forming terraces more or less parallel to the existing coast-line, are observed on our own shores. Along several of the firths of Scotland they are very conspicuous, though by no means confined to them, or to that part of the kingdom. They vary in height from twenty-five to several hundred feet above the highest rise of the tides, and are distinguished by the presence of rounded pebbles, gravel, sand, and sometimes sea-shells. It cannot be doubted that these are the sea-margins of a former age; and appearances indicate clearly, that they were raised to their present sites by a

force which elevated the land gradually, not by paroxysmal effort. It must, however, be understood, that, though such displacements are referable to existing causes of terrestrial change, the events themselves belong to pre-historic times, and seem to antedate the appearance of man in this part of his earthly home. The deserted beaches contain no memorials of the human race in the shape of fabricated articles, which are so common on the present coast lines, nor is there any evidence with us, as in the case of the Scandinavian shores, of any alteration in the relative level of land and sea having taken place during the historical epoch. In several instances, it is plain that the land must have been raised at different and distant intervals; for in the same locality, a succession of beaches, rising one above another, may be observed, as in the isle of Jura, one of the Hebrides. But the most remarkable example of these former rims of the waters is furnished by the Parallel Roads of Glen-Roy, so called from their perfect regularity and resemblance to artificial constructions. Three terraces, at the heights of 872, 1,085, and 1,165 feet, run along the hills on both sides the valley of the Roy, in Inverness-shire, and are traceable in the connected glens, apparently formed when the valleys were the beds of quiet estuaries or arms of the sea. In former times, they were regarded with wonder and awe by the inhabitants of the district, who, unable to account for their formation by natural causes, viewed them as roads constructed by Fingal, one of their traditional heroes, for hunting purposes.

Attention will now be restricted to changes of known occurrence during the historical era, resulting from agencies which are still in action, and are producing the same effects.

CHANGES OF THE COAST-LINE.

Incidental reference has been made to encroachments of the sea at certain points of the coast, and to large tracts of land having been reclaimed from the dominion of its waters at others. But these antagonistic operations deserve further notice, owing to the great alterations effected by them in the lapse of ages, and since the date of our historical documents. Towns and villages have been swept away by the ravages of the deep; while others, once maritime, are now inland, having been removed from the seaboard by the formation of a new shore. Hence farms and homesteads now exist where the waves formerly freely sported; and barks sail over sites where fishermen have had their cabins, peasants their cottages, and burghers their dwellings. Brighton, when a fishing village in the reign of Queen Elizabeth, occupied a tract over which the billows have long rolled and the chain pier has been extended. Rye, on the other hand, one of the most flourishing of the Cinque Ports in the time of the Plantagenets, once destroyed by the sea, is now two miles distant from it. It seems certain, that, when Cæsar advanced to the coast, the sea had possession of the present site of Dover, and penetrated for some distance the depression in the chalk forming the valley in the back-ground. The gradual accumulation of sand and shingle washed up by the tide, and especially by south-westerly storms, has changed the surface into a habitable position, and has long threatened to block up the mouth of the existing harbour. Similar examples of ground gained and land lost have occurred in the most marked manner on the east coast of England; and attention will be chiefly directed

to that side of the island, as the records of alteration are well-authenticated, and the evidence of it is often very sensible in the short space of individual life. Low cliffs of clay, sand, gravel, and chalk-rubble, largely compose the sea margin, which readily yield to the action of the boisterous element.

An exposed shore is slowly yet surely dilapidated by the constant fretting of the waves and grinding of the tidal currents, which, with the decomposition effected by the atmosphere, prepares the hardest rocks to be breached by the mechanical force of the billows, when impelled by violent gales. In the case also of low coasts and extraordinary storms, the sea sometimes overleaps or breaks through its usual barriers, sweeps them away entirely, inundates the interior levels, and effects an enlargement of its domains by sudden irruption, which has often been permanently retained. An obscure tradition has been handed down, that the Goodwin Sands, off the coast of Kent, once formed part of the main land, and of the estates of Earl Goodwin, the father of Harold, which the sea overwhelmed towards the close of the eleventh century. However this may be, it is certain that the dreaded shoals, like a remnant of land, consist of sands accumulated upon blue clay, and subjacent chalk, and that, while such inroads have repeatedly occurred, our early annalists mention extensive depredations committed by the ocean upon the shores at the time referred to. Thus Florence of Worcester states:—"On the third day of the nones of Nov., 1099, the sea came out upon the shore, and buried towns and men very many, and oxen and sheep innumerable." The Saxon Chronicle also records under the same year:—"On St. Martin's mass day, the 11th of Novembre, sprung up so much of the sea-flood, and so mykle harm

did, as no man minded that it ever afore did." But, unlike human spoilers, the sea offers compensation for its ravages, often depositing the material of the invaded shores at no great distance from the scene of havoc, where it may speedily be made available by industry for the purposes of human existence and comfort. Thus the navigable channel between the isle of Thanet and the rest of Kent, through which the Roman fleets sailed on their way to and from London, has long ago been rendered pasture land, or cultivable ground, by successive deposits of marine silt.

At various points of the coast of Suffolk, where the sea is from fifteen to twenty feet deep at low water, harvests were reaped and dwellings existed at no remote period. The history of Dunwich exhibits a remarkable struggle for existence with the advancing waves, traceable through nearly eight centuries. Though at present a small village of about twenty houses and a hundred inhabitants, it was formerly one of the most important places on our eastern shores, a parliamentary borough, with twelve churches, and the seat of the first East Anglian bishoprick, subsequently transferred to Norwich. It is mentioned in ancient writings, that a wood once existed a mile and a half to the east of the town, the site of which must now be so far out at sea, since almost every remnant of old Dunwich has been engulfed; and, but for the inhabitants retreating inland, the name itself would not now represent a single dwelling. Two tracts of land, which were taxed in the reign of Edward the Confessor, had been devoured when the Domesday survey was made. At different intervals, a monastery has perished, several churches, the old port, four hundred houses at once, a high road, town-hall, and jail. In the year 1740, the waves reached the

churchyard of St. Nicholas and St. Francis, when coffins and skeletons were exposed to view in the cliffs, from which the bones successively dropped to the beach, and were borne off by the remorseless surge. The scene might have suggested to Bewick the subject of one of his remarkable cuts. It represents a cliff undermined, with the tower and western end of an abbey standing on the verge; the eastern aisle is gone; the waves are invading the cemetery; a skull rests upon the beach; and a broken tombstone is shown, on which a cormorant is perched, as an emblem of the all-devouring ocean.

Equally striking changes have taken place on the coast of Norfolk, both by way of gain and loss. In early times, the river Yare formed a spacious estuary extending up to Norwich. That city, now considerably inland, is spoken of in the thirteenth and fourteenth centuries, as situated on the banks of an arm of the sea. But a line of sand-hills gradually formed across the mouth, leaving only a narrow passage for the river, which its own outfall kept open. Owing to the ingress of the tides being thus checked, the estuary was silted up; and the ancient arm of the sea has been superseded by thousands of cultivated acres, with a number of fresh-water lakes and pools. In other parts of the county, the sea advances upon the land at a surprisingly rapid rate. Mr. Lyell makes the following remarkable statement respecting Sheringham:—"I ascertained, in 1829, some facts which throw light on the rate at which the sea gains upon the land. It was computed, when the present inn was built in 1805, that it would require seventy years for the sea to reach the spot: the mean loss of land being calculated, from previous observations, to be somewhat less than one yard annually. The distance between the house and the sea was fifty yards;

but no allowance was made for the slope of the ground being *from* the sea, in consequence of which, the waste was naturally accelerated every year, as the cliff grew lower, there being at each succeeding period less matter to remove when portions of equal area fell down. Between the years 1824 and 1829, no less than seventeen yards were swept away, and only a small garden was then left between the building and the sea. There was in 1829 a depth of twenty feet—sufficient to float a frigate—at one point in the harbour of that port, where, only forty-eight years before, there stood a cliff fifty feet high, with houses upon it. If once in half a century an equal amount of change were produced suddenly by the momentary shock of an earthquake, history would be filled with records of such wonderful revolutions of the earth's surface; but, if the conversion of high land into deep sea be gradual, it excites only local attention. The flagstaff of the Preventive Service Station, on the south side of this harbour, was thrice removed inland between the years 1814 and 1829, in consequence of the advance of the sea."

From Spurn Point to Bridlington Bay, on the Holderness coast of Yorkshire, a distance of about thirty miles, the ocean encroaches gradually but steadily, at a varying rate in different places, much depending on the composition of the cliffs, the configuration of the land, the set of the tides, and other circumstances. Recently a cause came on for trial in the Court of Queen's Bench, between the parish authorities of Hornsea and the magistrates of the district. The former were bound to keep a certain road in repair which was finally entirely washed away; the latter sought to compel them to make another on the ground of the obligation; but, as it was impossible to do so on the site, Lord Campbell ruled

that the sea had released them from the bond. The town of Ravenspur, or Ravenspurn, a name of Danish origin, in the neighbourhood of Spurn Point, often mentioned in our annals, has long since disappeared. It became a borough at the same time with Hull, sent members to Parliament during the reigns of the three Edwards, and was a favourite point of embarkation. Baliol and the confederate barons sailed from it for the invasion of Scotland in 1332; and Bolingbroke, afterwards Henry iv., landed there in 1399, to effect the deposition of Richard II. Soon afterwards, the threatening billows became dangerous neighbours; and the inhabitants made a formal presentation of their difficulties to the Crown. But, the case admitting of no remedy, they had to abandon the site. The sea invaded the town and swept away the buildings; but no record exists of the precise date of its destruction, nor can its particular locality be pointed out.

The tapering promontory of Spurn, marked with a lighthouse at the extremity, is a low barren ridge of sand and shingle, stretching about four miles from the village of Kilnsea, only a few hundred yards across, bounded by the ocean on one side, and by the Humber on the other. In the year 1835, as a solitary horseman was returning from a visit to the lighthouse, he dismounted and left the beaten track in order to proceed more immediately by the beach, leading his steed by the bridle. Agates, carnelians, amethysts, chalcedonies, and a variety of jaspers are frequently picked up. But he had not proceeded far before his attention was called off from the search by the stranded carcase of a porpoise which some gulls were eagerly devouring; and a little farther on, among the pebbles at his feet, lay indubitable relics of his own species. There was a bone,

apparently human—then another—the leg and thigh bone of a man who had once trod the surface as firmly as himself. Last of all he found what would have sufficed to dispel all doubt as to what creature the bones belonged to, had any existed—a skull. The spectacle brought the traveller, Sir George Head, to a pause, and naturally suggested various reflections. He examined the fragments, handled them gently, restored them to their place, and journeyed on indulging melancholy musings respecting the sad fate of shipwrecked seamen, yet wondering at the state of feeling which could have permitted the body of a fellow-creature to remain exposed upon the beach till every semblance of humanity had departed, and the merest wreck of the frame survived. But on reaching Kilnsea, and relating the adventure, his conclusions were corrected. The old deserted church of the village, undermined by the sea, had fallen. The churchyard, where generations slumbered, was in process of being consumed by the waves, giving up its dead to their imperative mandate and rude disposal—hence the bones.

The village stands upon a projecting point of a line of cliff, earthy and soft, consisting of beds of clay, gravel, and sand; and, rising gradually from the low spit at Spurn, it here attains the height of about thirty feet. The turbulent North Sea continually beating against this yielding barrier wears it away, especially when the swell is heavy, rendering the position of the dwellings remaining on the verge continually more insecure. But there is no real danger to the occupants, as the sea does not perform its work stealthily, as man often acts to his fellow-man, coming down upon him as a thief in the night. The prey is attacked openly by the billows, at all hours, by day and by night; and the spoil is

won gradually, so that timely warning of impending destruction is given by the progressive rate at which the foe advances to the conquest. But to a stranger, it seems perilous to dwell on a site which has an enemy so potent close at hand—the spray of the storm beating against the windows; and melancholy reflections arise, that inevitably must the hearth-fire be extinguished to blaze no more on the spot, and the sea-weeds grow where childhood at present prattles. The church fell in the year 1826. At the period to which we have been referring, its ruins formed a mound of considerable height at the base of the cliff, in which were large masses of the walls still adhering, and fragments of the rounded spire.

A few miles to the north, the old church of Withernsea has shared the fate of the one just noticed; and, through the thirty miles of coast extending from Spurn to Bridlington, there is similar wear and tear in operation, which has been going on from a period antecedent to any written or traditional history. The submerged forest of Hornsea is one evidence of this. A black line or reef of peat runs seaward along the shore, marking the ancient position of a woodland below high-water mark, over which the waves of every tide now roll. The peat may be kneaded like dough into balls when first taken up, but becomes hard on drying, and, if cut by a knife, the divided surface may be polished like marble. Among the towns and villages known to have been destroyed are Auburn, Hartburn, Hyde, and Owthorne; to which two more may be added, mentioned by Camden, but no longer existing, Upsal and Pennismerk. Respecting the rate of waste, some data of interest were presented to the British Association at the Hull session. Thus, in 1786, the cross at Atwick was 946 yards from

the edge of the cliff; in 1836, it was 811 yards distant; and in 1853, only 770 yards, showing an average annual loss of two and a half yards. The east end of Hornsea church, in 1786, was distant from the sea 1,333 yards; in 1836, it was 1,000 yards from high-water mark; and in 1853, but 912 yards distant, so that the average loss had increased in the last seventeen years from two yards to three and a half per annum. Aldborough church, in 1786, was 2,044 yards from the sea; in 1853, it was 1,910 yards, making a loss of two yards annually. The distance of Holmpton church from high-water mark had been reduced in the same interval from 1,200 to 1,120 yards. At Kilnsea, the village inn, named the Blue Bell, built at the recent date of 1847, is now nearer the sea than at the time of its erection. It was then 534 yards distant, which has been abridged to 488 yards, showing an annual loss of seven and a half yards. If this rate of consumption is kept up—and it is tolerably uniform at the same place—its lease of security will expire in about sixty-five years. The infant of to-day may therefore live to see its inmates ejected, and the walls tumble from the cliff upon the strand, for the waves further to disperse its ruins.

The average loss of land on the whole of this coast is moderately estimated at about two yards and a half annually. This is equal to an area of thirty-three acres—a field of respectable dimensions every year carried off by the ocean. But another calculation may be made. The wasting cliffs extend about thirty miles, the average height being ten yards, and the average annual loss two and a half yards. By calculation, the total quantity of 1,320,000 cubic yards of fine sediment, coarse sand, pebbles, and boulders, is annually swept from this ill-fated shore—a quantity which would cover to the depth

of one foot an area of about 738 acres. But the ravaged material is not altogether lost to the shores, neither does it undergo any lengthened transport, for the process of addition to the coast is carried on in close neighbourhood to that of the aggression. Shoals encumber the bed of the Humber, rendering careful navigation necessary, as they repeatedly shift before permanently settling. They are formed by deposition of the sediment suspended in the waters of the river, and have originated new land on both the northern and southern banks. The material is not carried down by the stream from the upper part of its basin, but brought into the estuary by the flood-tide from the wasting cliffs of Holderness, being deposited at high-water, when the river is in a quiescent state. As an instance of restitution going on in close proximity to spoliation, the story of Sunk Island is of singular interest. Two centuries ago, the spot so called answered to its name. It was a mud-bank in the Humber, separated by a broad navigable channel from the southern shore of Holderness, which forms the north boundary of the estuary. An enterprising man contemplated turning the small exposed surface to account; and took it from the crown at a nominal rent. Having embanked the spot, it was brought under cultivation; and, as the river continued its deposits, a larger area was successively embanked and reclaimed. In this way, Sunk Island has been extended, till all appearance of detachment from the main land has been lost. It has now its harvests, stock, farm-buildings, church, and labourers' dwellings, and yields a rental of several thousand pounds per annum to the Woods and Forests. In a similar manner, during the last half century, many proprietors of maritime lands have largely added to

their estates, by banking-in the deposits of the ocean. It is probable, therefore, that while the outline of the shores undergoes great changes, and the relations between land and sea are constantly altering, the extent of their respective territories is very stable.

SAND DRIFTS.

The sands washed up by the sea on low shores, and piled in hills by the mechanical agency of the winds, have materially altered the features of many parts of our coasts, converting fertile tracts and inhabited sites into deserts as sterile and desolate as the African Sahara. This has been effected both by gradual drifting under the direction of prevailing winds, and by sudden irruption, in the form of a sand-flood, under the action of violent tempests. At Southport, in Lancashire, a town which lies between parallel ranges of sand-hills, the loose particles are shifted by a gale sometimes in enormous quantities, covering the gardens to a considerable depth, and overtopping the lower apartments of the houses. In situations where the habitual direction of the wind is from the sea, the sand is carried inland, and the formations gradually acquire greater breadth; but where the wind blows generally along the shore, the sterile downs have a tendency to extend themselves coastwise. It is now well known that certain plants may be advantageously used to bind together loose sands with their matted roots, and prevent all drifting, of which the Sand-reed, *ammophila arundinacea*, is by far the best. But in former times the inhabitants of threatened sites were either too ignorant or negligent to apply a remedy, and witnessed as the

consequence the sternest desolation gather over fruitful fields and smiling landscapes.

A remarkable example of one of these invasions occurred towards the close of the seventeenth century, in the north of Scotland, provoked by the folly of the peasantry. West of the river Findhorn, a district of more than ten square miles, chiefly included in the barony of Coubine, was renowned as the granary of Moray, on account of its extreme fertility. But it was turned into a dreary wilderness and depopulated as well as rendered unproductive by wind-blown sands. The first irruption commenced about the year 1677, and twenty years afterwards, in 1697, scarcely a vestige of cultivation was to be seen; while the manor-house, offices, and orchards were smothered with the drifts. The sand came from the shore about seven miles west of the mouth of the Findhorn, where, from time immemorial, large heaps of it had been accumulated. The hills had till then been fixed by being covered with vegetation, but were set at liberty by the inhabitants inconsiderately pulling up the bent and juniper for various uses, when a drifting immediately commenced to the east. A high wind has been known to carry the finer particles across the whole bay of the Findhorn, and a marked change has been produced in the direction of the river. Its mouth being blocked up by the sand, the stream had to cut out a new channel, by which change the old town of Findhorn, which originally stood on the east side, was left upon the western bank. The desolation of this tract has continued to the present day, with the exception of some places which have been cleared by human industry, exposing the ancient rich soil of the barony.

A district on the north coast of Cornwall, once

cultivated and inhabited, has for centuries been covered with sands blown up from the sea, which now form hills rising several hundred feet above its level, largely composed of minute fragments of marine shells. In several places the sand has undergone induration, owing to oxide of iron held in solution by the water which percolates through it. Blocks of it are used in the neighbourhood for building purposes, and, as the process is in various stages of advance, the gradual formation of a sandstone-rock may be traced at the spot. No chronicle has recorded the time when the sands began to accumulate, or the particular circumstances of the drifting. But the discovery of ancient buildings completely buried, as the recently exhumed church or oratory of St. Piran, the still recognised patron of the Cornish miners, who flourished in the fourth century, proves beyond all doubt the formation of the sand-hills since that date. A similar instance occurs on the coast of Norfolk, where several villages have been destroyed by the two-fold agency of the sand and the sea. In 1605, the inhabitants of Eccles petitioned James I. for a remission of taxes, as a large proportion of their lands, with their houses, except fourteen, had been carried off by the waves. The houses then spared have since been buried beneath hills of blown sand, and both are destined speedily to become the prey of the devouring deep. A monument of the hapless village remains in the ruined tower of the old church, still visible above the sands, which have completely entombed the body. On the coast of Sligo, in Ireland, an equally destructive sand-inundation has taken place, covering upwards of seven hundred acres of fertile land, and burying a considerable village in its course. In spite of the change, the inhabitants have clung to

the spot, and live like rabbits in their burrows. Only the roofs of the cabins are visible, and these, with the entrances, are alone kept clear by the constant labour of the inmates. It is strange to the wanderer in this wilderness, where scarcely a blade is to be seen, to come suddenly on a rude chimney, apparently projecting out of the earth, while a troop of ragged children rises up at his feet.

RIVER FLOODS.

While all streams, from the trunk river to the thinnest rill, are ever active agents in the disengagement, transport, and deposition of soil, producing great changes in the lapse of centuries, the effect of their ordinary mechanical action in modifying the surface is seldom apparent with us, owing to its gradual occurrence and the comparative insignificance of our flowing waters. But locally, in the highland parts of the country, the temporary torrents that are called into existence by heavy rains, and the floods of the permanent streams, occasionally alter the features of the landscape in a very striking manner, and illustrate the transporting and erosive power of currents. During the local deluge that visited Aberdeenshire and the adjoining counties on the 3rd and 4th of August, 1829, new ravines were formed on the sides of the mountains, vast masses of rock were transferred to fresh sites, deep pools were converted into shallows by the amount of debris left in them, the sloping banks of streams were cut into vertical walls by the rush of the floods, and some of them were permanently diverted into newly excavated channels. The Don, upon the property of Mr. Farquhar-

son, forced a mass of four or five hundred tons of stones, many of them of great size, up an inclined plane, rising six feet in ten yards; and a block of nearly four tons' weight, which had long been remarked in a particular part of the river, was borne upwards of a hundred yards out of its place. An eye-witness observed, that he had seen the waves of the Atlantic rolling in the Pentland Firth, and wasting their strength on the iron-bound coasts of the north, but that even there the impression of power was less vivid than that produced by the rush of the river.

For two days and the intervening night the rain fell in torrents without intermission, accompanied with all the features of a tropical hurricane, sudden and violent gusts of wind, thunder, and lightning such as is rarely experienced in our climate. The basins of the Spey, Findhorn, Divie, Dee, and Don, were inundated by their swollen waters, which carried away bridges, roads, crops, and buildings, and left permanent marks of change on the face of the country. Sir T. D. Lauder mentions the loss, upon his own estate at Relugas, of ten thousand points of locality, on which hung many long-cherished associations. "On Sunday," he observes, "the 2nd of August, I returned from church by the river walk. The day was sultry and cloudy, and a gentle shower began to fall, which hardly penetrated the canopy of leaves overhead, and but added freshness to the surrounding natural objects: this was the beginning of the rain. The rocks and recesses of the wooded banks and the grassy slopes were covered in a wild way with many thousand shrubs of all kinds, which were thriving vigorously and beginning to bear blossoms, while the rocks were covered with the different saxifrages, hung with all sorts of creepers, enamelled with a

variety of garden flowers, all growing artlessly, as if sown by the hand of nature. The path was therefore considered to be not unworthy of the exquisite scenery through which it led; but the flood of the 3rd and 4th of August left not one fragment of it remaining from one end to the other. Not a tree, or shrub, or flower, or piece of soil, nay, or of moss or lichen, is to be seen beneath that boldly and sublimely sketched line of flood, that appears on either side and from end to end of these rocks, like the awful handwriting of God upon the wall. Never did the unsubstantiality of all earthly things come so perfectly home to my conviction." This is a sample of the changes produced through a wide extent of country by the furious outburst of the streams.

The same interesting describer has recorded a series of transitions at a point in the course of the river Nethey, the work of successive floods, occurring in the space of a century. At one time, a company were pounding iron-ore with ponderous hammers, moved by machinery in its bed. These persons disappeared, and the river soon obliterated all traces of their works. Its own channel there was filled up by a mass of stones and gravel, brought down by a flood, upon which its waters were compelled to seek another bed to the westward. But the spot was visited by quieter succeeding inundations, which gradually deposited fertile soil, and formed a rich piece of land, the surface of which was several feet above the level of the ground occupied by the iron-masters. Part of this flat was brought under cultivation, while a beautiful grove of nature's planting grew upon the remainder. The tilled land yielded a bountiful return to the husbandman, the trees became tall and majestic, till the great flood of 1829 came down.

The grove was then uprooted, the corn-land was swept away, the entire alluvial mantle was torn from the spot, and the marks of manufacturing industry were again exposed to the face of day.

PEAT-MOSSES.

The formation of a peat district is a very rapid process under favourable circumstances, and the production of such districts upon a very extensive scale has undoubtedly been effected in comparatively recent times in various parts of the kingdom. It is related by George, earl of Cromartie, that in 1651, when nineteen years of age, he noticed a spot in the west of Ross-shire, as a plain covered with standing wood. The trees were leafless, and stripped of their bark. This was evidently a forest in one of the last stages of its existence. When again in the neighbourhood, some years afterwards, he found the plain completely shorn of its trees, and presenting the aspect of a flat green ground overspread with moss. Upon inquiring what had become of the trees, and who had carried them away, he was informed that they had all been uprooted by the winds and lay underneath the moss; and before the year 1699, he states that the country-people came there to dig turf and peat. Thus in the space of half a century the same site was a woodland and a peat-moss; and the transition from the one to the other is susceptible of a very natural explanation. By interrupting the drainage—preventing the rains running from off the surface—the prostrate trunks contributed to render the ground marshy—a condition favourable to the growth of mosses. Upon taking possession of the site, the mosses

speedily embedded the trees, and produced by their own decay the spongy vegetable mould which, when consolidated and dried, is serviceable fuel. In a similar way, over extensive tracts, woods have been followed by swampy wastes, though man, not nature, has been the prime agent in clearing the ground. The Romans burned or cut down the forests, because they harboured the unconquered natives; Henry II. adopted the same policy in Ireland, for the like reason; Edward I. also in Wales; and at different periods, by authority of parliament, the same measure was ordered, to deprive outlaws and wolves of a shelter, while the timber was left to rot upon the ground. Hence the occurrence of subterranean forests, almost always associated with peat-swamps as their sepulchre.

A vast tract of low country in south Yorkshire, embracing part of north Lincolnshire, the property of the crown, was a spongy moss in the reign of Charles I., abandoned to red-deer, but soaked with water through an extensive area for a considerable portion of the year. Sir Cornelius Vermuiden, a Dutchman, purchased this desolate waste, known as Hatfield Chase, including nearly two hundred thousand acres, with the view of reducing it to arable and pasture ground by drainage. In the course of this operation, which was successful, though at an immense cost, evidence was obtained of the former existence of a forest at the site, which had flourished for generations. Multitudes of roots and trunks of trees were found, of all sizes, and of almost every species common to our islands—oaks, pines, birch, beech, yew, willow, and ash. The roots of the greater part were standing in the soil in their natural position; and the trunks were lying by the roots to which they belonged. The smaller trees were disposed in all

directions; but the larger were stretched to the north-east. The greater number were pines, some of which were more than thirty yards long, and in such condition as to be sold for the masts and keels of ships. One specimen measured thirty-six yards, and was estimated to be deficient at least fifteen yards, making in the whole fifty-one yards, or 153 feet. Mr. Phillips states, that the highest tree of this kind that ever fell under his notice was a spruce fir, growing near Fountain's Abbey, which was 118 feet above the grass. Oaks were found, black as ebony, capable of use, some of which were of larger dimensions than those of any tree now existing in the kingdom. One had a diameter of four yards at the base, three and a half yards in the middle, and two yards at the top, which was broken off; and the remainder of the trunk was forty yards long. Acorns, hazel-nuts, and bushels of fir-cones were met with. Many of the trees, especially the pines, bore marks of having been burned; others of having been chopped and split, for large wooden wedges and broken axe-heads, somewhat like sacrificing axes in shape, were found sticking in them. Near a large root in the parish of Hatfield, several coins of the Roman emperors were discovered, corroded and defaced by time; and in other places, coins of Vespasian, axes, and links of chains. It is perfectly clear, that the Romans destroyed in this district a grand primeval forest, partly by the axe and partly by fire, availing themselves of a south-west wind, the strongest and most prevalent that blows in our islands, to spread the conflagration; and hence the general direction of the larger trees that were felled to the north-east. In the natural order of events, the realm of the pine and oak became a morass overgrown with aquatic vegetation, increasing in thickness in the

course of centuries; and the region once sustaining timber sufficient to supply the navies of Europe remained sterile, till drainage was applied, when the vegetable soil was turned by the husbandman into pasture and corn-land.

While many of the peat-mosses have been entirely formed since the fall of the forests, others of far older date, and unconnected altogether with prostrate timber, have advanced in extent and thickness by the natural increase of the vegetation. Where the conditions essential to growth remain unaltered, observable changes are effected in a series of years. Mountain tarns and pools are reduced to bogs, or are in process of reduction, by the vegetable formations filling up the area occupied by the water, and superseding it by carbonaceous matter. Invasions of this kind may be remarked around the small lakes of Wales, Cumberland, and Scotland.

It is interesting to observe, that peat mosses possess, in a high degree, the antiseptic property, or the power of preserving animal substances from putrefaction. Hence human remains, buried accidentally or by design in them, have been found by turf-diggers in a remarkably perfect state of preservation, after long intervals of time; and points of ancient costume have been brought to light by the discovery. Thus on the estate of the Earl of Moira, in Ireland, a human body was dug up from beneath one foot of gravel and eleven feet of moss. It was completely clothed, and all the garments seemed to be made of hair, which was generally employed for clothing before the use of wool was known. Yet, though thus belonging to a very early period, the body was fresh and unimpaired. In June, 1747, the body of a woman was found, six feet deep, in a peat-moor, in the Isle of Axholme, in Lincolnshire, which showed scarcely

any marks of decay, though plainly declared by her costume to be a lady of the olden time. She wore sandals, each cut out of a single piece of tanned ox-hide, folding about the foot and heel, and piked with iron. Sandals or shoes of this description were fashionable in the age of Chaucer.

After heavy rains, peat-mosses often exhibit considerable enlargement, bulging out like a bladder into which air is blown. Though the turfy covering is generally sufficiently tenacious to endure the strain, yet it occasionally happens, when overcharged by excessive and protracted showers, that the swollen mass gives way suddenly, and pours its contents upon the adjoining lands, resembling in semi-fluidity and rate of progress an ordinary lava-current. This occurred in the case of the Solway moss, on the 16th of December, 1772. After swelling to an unusual height above the plain and valley of the river Esk, an eruption took place, an entirely new phenomenon in the history of that pastoral district. The hour at which it occurred, eleven o'clock at night, when the inhabitants of the farms and hamlets had long retired to their beds, added to their terror and danger. Some were aroused by the strange noise of the novel torrent; others by the cries of alarm, which speedily ran through the length and breadth of Eskdale; and many, on opening their doors, had immediately to encounter a slowly-rolling, irresistible, and inexplicable inundation of black mud. Thirty-five families saved their lives with difficulty, but lost their effects, agricultural produce, and many of their cattle; while fields, gardens, hedgerows, and cottages, were covered with a mass of dark, slimy, half-consolidated peat-earth. It extended over four hundred acres, in some parts to the depth of fifteen feet, while the height of the original moss sub-

sided twenty-five feet. Similar eruptions of the bogs have taken place in Ireland.

LANDSLIPS.

The atmosphere tends to disintegrate rocks, or separate their particles, and produce a crumbling state of the surface, by its oxygen being absorbed by the mineral masses. Granite, and the hardest masses belonging to the globe, wherever exposed to the open air, are thus incessantly acted upon; and useful soil is prepared by this process of pulverization. The solvent power of the rains and the mechanical agency of the winds, also contribute to the waste of rocks; and when the water retained in cracks and fissures is frozen, it acts by its expansion to rend completely asunder the disjoined parts, detaching immense fragments, and precipitating them to lower levels. Hence the ruins or landslips that lie at the base of precipices, the components of which may vary from the finest powder to blocks of many tons, are gradual accumulations formed by the wear and tear of the atmosphere. Much, of course, depends upon mineral composition and structure, as to the liability of exposed masses to pulverize and splinter under the action of the elements. *Man Tor*, one of the *Derbyshire* hills, composed of alternate layers of shale and grit, is popularly celebrated in its neighbourhood as the “*shivering mountain*,” owing to this tendency, which, according to vulgar rumour, occasions no diminution of bulk. In winter, as the effect of frost, and after unusual rains, huge fragments are detached on the precipitous side of the hill, and fall to the vast mound of ruins at the base, with a noise that is heard in all the adjoining valleys. *Shakspeare’s Cliff*, at *Dover*, with the entire range of

the chalk escarpment in the neighbourhood, has suffered frequent disruption from the same causes, as well as by the undermining of the sea.

Springs acting upon yielding strata of sand or gravel, on which masses of solid rock are incumbent, gradually wash away the foundation, displace and derange the superstructure, producing land-slips, occasionally upon a very extensive and tremendous scale. The series of terraces, with the heaps of ruins, which distinguish the Undercliff, in the Isle of Wight, some of which are of recent occurrence, have been formed in this manner. Our ancient chroniclers have made the most of such events, as of the slide of Marley Hill, Herefordshire, nearly three centuries ago. "Near to the confluence of the Wye and the Lugg, to the east," Camden relates, "a hill, called Marley Hill, in the year 1575, rose as it were from sleep, and for three days moved on its vast body with a horrible noise, driving everything before it, to the great astonishment of the beholders." In "Baker's Chronicle" also we read: — "In the 13th Queen Elizabeth, a prodigious earthquake happened in the east part of Herefordshire, at a little town called Kinaston. On the 17th of February, at six in the evening, the earth began to open, and a hill with a rock under it, making at first a great bellowing noise, which was heard a great way off, lifted itself up, and began to travel, bearing along with it the trees that grew upon it, the sheepfolds and flocks of sheep abiding there at the same time. In the place from whence it was first moved, it left a gaping distance forty feet broad, and fourscore ells long, the which field was about twenty acres. Passing along, it overthrew a chapel standing in the way, removed a yew-tree standing in the churchyard from the west to the east; with

like force, it thrust before it highways, sheepfolds, and trees, made tilled ground pasture, and again turned pasture into tillage. Having walked in this sort from Saturday evening till Monday noon, it then stood still." Drayton, in his "*Polyolbion*," refers to this movement of Marley Hill:—

"Inrag'd and mad with griefe, himself in two did rive,
The trees and hedges neare before him up doth drive;
And dropping headlong downe three daies together fall,
Which, bellowing as he went, the rocks did so appall,
That they him passage make, who cotes and chapells crusht,
So violentlie he into his valley rusht."

Very extensive landslips have occurred in the neighbourhood of Folkestone, in Kent, and a memorable slide on the coast of Dorset took place in the year 1792. "Early in the morning," Hutchins records, "the road was observed to crack. This continued increasing, and before two o'clock the ground had sunk several feet, and was in one continual motion, but attended with no other noise than what was occasioned by the separation of the roots and brambles, and now and then a falling rock. At night it seemed to stop a little, but soon moved again, and before morning the ground, from the top of the cliff to the water-side, had sunk in several places fifty feet perpendicular. The extent of ground that moved was about a mile and a quarter from north to south, and six hundred yards from east to west." The Axmouth land-slip, on the same coast, December 24, 1839, was still more extensive and remarkable. Springs having gradually loosened and removed the sandy substratum of the chalk downs, the incumbent masses sank and slid forwards, rending the walls of tenements, while fissures were seen opening in the ground, and the original surface was thrown into the wildest confusion.

EARTHQUAKE-SHOCKS.

Though extensive displacements of the surface as the effect of earthquakes have only been known in foreign lands, at least in historic times, yet, as this cause of geological change is occasionally in operation within our borders, it is proper to notice its exhibitions, as they have come under popular and scientific observation. Mr. Milne has compiled a chronological account of those shocks occurring in Great Britain, which have been mentioned by authors, from the beginning of the seventeenth century down to the autumn of the year 1839. The number is far greater than might have been supposed; and the record justifies some interesting conclusions. During the interval, 116 were experienced in England, and 139 in Scotland, making a total of 255. They may be distributed into two classes—general and local.

The *general* shocks, or those experienced through a wide area of the kingdom, are of rare occurrence. They are mostly, if not exclusively, of foreign origin; and reach us as mere vibrations propagated mechanically along the earth's surface, from some focus of disturbance in a distant region. The most remarkable example of this class, the great Lisbon earthquake, on the morning of November 1, 1755, was felt at distant points of England, Wales, Scotland, and Ireland. This was within an hour, or an hour and a half, of the desolation of the continental capital, the intermediate time being occupied in the concussion travelling through the intervening mass of strata. On several occasions, earthquakes have occurred on the same day in this and foreign countries, particularly Italy. But as there has been no appearance of commotion in the interposing

region, such events may have no physical connexion, and be nothing more than coincident displays of the same phenomenon.

The *local* shocks, or those which affect only small sections of the country, and are sometimes restricted to very limited areas of counties, comprehend the vast majority of British earthquakes; and may be regarded as truly indigenous, or of home origin. Instead of being transmitted from foreign regions of disturbance, they appear to originate in, or emanate from, points immediately beneath the surface of our islands, at an unknown depth. This conclusion, besides being inferred from the scant limits of the areas affected, is sanctioned by the consideration, that in all the districts disturbed, there is usually some spot where the concussion and attendant noise are greater than anywhere else; that both shock and sound move simultaneously in all directions from this spot; and that both diminish in intensity with the distance from it. Out of the 116 shocks recorded as having been observed in England, 31 were confined to the south coast, 14 to the borders of Yorkshire and Derbyshire, 5 or 6 to Cumberland, and 31 occurred in Wales. In Scotland, out of 139 shocks, 23 emanated from the Great Glen or its vicinity, and no less than 85 from Comrie or its neighbourhood.

The remarkable number returned in connexion with the last-named place, a village in Perthshire, is a well-attested fact. The Rev. Mr. Gilfillan, a very intelligent clergyman, who resided there upwards of thirty years, was in the habit of noting in a private journal, not only the dates of any shocks which occurred, but also any striking effects or appearances which accompanied them. This practice was so well known, that he acquired the popular title of "Secretary to the Earthquakes." But

shocks have been still more numerous since the date of the register referred to; some very remarkable for their violence. Mr. Macfarlane, the postmaster of the place, well qualified to observe and record natural phenomena, noted and described 217 in little more than two years; or, from October, 1839, to December 7, 1841. The exhibitions of subterranean action with such extraordinary frequency, in this otherwise obscure locality, has attracted great attention to it. Comrie lies in a kind of basin, being almost completely surrounded by hills. It is bounded on the north by the base of the Grampian range; on the west by the Aberuchills hills; on the south and east by ridges of rising grounds. Among the hills on the north, forming part of the base of the Grampians, lies a small lake, in the centre of a circular glen; and at, or very near this spot, general opinion has placed the seat or focus of the earthquakes.

The peculiar motion, which the French fitly represent by the phrase *tremblement de terre*, is invariably noticed in all our earthquakes. The sensation produced is described as very similar to that experienced on board a steamer, when, in letting off the steam, the plates of the boiler communicate a tremulous motion to the deck. In the more severe shocks, it has been compared to that felt by a person riding, when the horse shakes himself. Among other commonly observed effects, the vibration of flames of candles, the clatter of furniture, the rattle of slates on roofs, the quivering of trees and hedges, and the emission of sounds from the strings of musical instruments, are mentioned. But besides this trembling of the earth's crust, another kind of shock is usually felt, resembling that of a violent blow or concussion. When this occurs, it is generally in the midst of the tremors, and at the moment of their greatest

intensity; and the loudest noise accompanies it. So well known is this concussion or blow in the neighbourhood of Comrie, that the country people there have a particular name for it, that of the "Thud." In illustration of its character and effects, it may be remarked, that on the 5th and 11th of November, 1789, the shock felt on the first of these dates gave the sensation as if the foundations of the dwellings had been struck by an immense mallet; while that on the second shivered to pieces the ice on a lake near Lawers House. During the earthquake at London, on the 8th of March, 1750, which was confined to its vicinity, and was most violent along the course of the Thames, a boatman felt as if his boat had received a blow at the bottom, and fish were observed to leap three feet out of the water,—probably from fright caused by the concussion.

The motion communicated to the earth's surface by the shocks noticed in our records, appears to be of three distinct kinds, vertical, horizontal, and complex or rolling.

As an instance of the *vertical* movement, Mr. Gillfillan relates of one of the Comrie earthquakes: "The concussion was perpendicular: the house in which I lodge seemed to be lifted or thrown directly upward, and fell down again with a sudden crash; but as the force was not so violent as to alter the centre, no harm was done to anything in it."

Dr. Stukely states, in illustration of the *horizontal* motion, that in the West Riding of Yorkshire, December 30, 1739, when there was a sudden and violent shock, "the earth moved backward and forward horizontally—quivering with reciprocal vibration." At London, in 1750, the general impression was that the whole

city was violently pushed to the south-east, and then brought back again. At Inverness, in 1816, buildings were suddenly pushed horizontally to the south-east; and left, as it were, behind them, stones and other objects not firmly attached, to which therefore the movement could not be instantaneously communicated. Sir Thomas D. Lauder thus describes his own experience of this shock: "The fabric of the whole building shook from its foundation; and the floor and the chair on which I sat, were several times moved powerfully up and down in quick succession, while, along with this vertical motion, I felt the chair rapidly agitated horizontally backwards and forwards, as if some Herculean person had taken it up with both hands from behind, and shaken it violently." These vertical and horizontal motions seem in many cases to combine, so as to produce the complex or *rolling* movement of the surface, which is precisely similar to that of a groundswell of the sea. Near London, in 1750, the dry and solid ground is described as having waved like the surface of a river, and the tall trees bent their tops. At Liverpool, on another occasion, a person compared the motion felt by him to that of being in a vessel falling from the top of one wave and rising again upon the next. In Shropshire, during a severe shock, in 1773, which caused great cracks, a field of oats was observed to heave up, and roll about like waves of water; the trees moved as if blown by the wind, though the air was at the time calm and serene.

Two kinds of sounds in general are discriminated in connexion with the shocks. The one is a rushing or whizzing noise, as if occasioned by a strong wind, or the rapid flow of distant waters, or the conflagration of a

large extent of heather. The other resembles an explosion; and has been variously compared to the loudest thunder, the discharge of artillery, or the blast of a quarry. The severest of the Perthshire earthquakes on record, which occurred on the 23rd of October, 1841, between ten and eleven o'clock at night, consisted of two shocks, separated from each other by about half an hour. The first and principal one embraced several concussions rapidly following each other. It was accompanied, says the Rev. Mr. Walker of Comrie, "with a noise in nature and intensity indescribably terrific—that of water, wind, thunder, discharge of cannon, and the blasting of rocks, appeared combined. Giving a short warning by a distant murmur, it gradually increased in intensity for some seconds, when at length becoming louder than thunder, and somewhat similar to the rush of the hurricane, it suddenly changed, and a noise resembling that of a blasting rock thrice repeated, followed, which again died away like distant thunder." At Uddingston, about six miles from Comrie, according to Dr. Porteus, the noise at the beginning was like that of "an immense number of carriages coming at full speed, growing louder as it approached. The house then received a concussion, as if struck near the foundation with a cannon-ball; it appeared lifted up and carried forwards; after the first concussion, the noise was hideous. The house now fell back into its position with another concussion. On this second concussion, the sound became fainter, and died away in the east with a distant growl. While the noise was still distant, it resembled the rumbling of carriages; but between the concussions, it was like the burr of a great many wheels running on each other. It was like thunder under the feet. It

was in the earth only." Concussions were felt far more in the upper parts of houses than in the lower ; and the higher the situation of houses on the hills, the less severe were the shocks.

Animals signified their alarm and distress on this occasion in a very marked manner. Dogs in the farm-houses ran to the doors, and howled mournfully ; the cows stood moaning in their stalls ; the horses endeavoured to break from the stables ; and birds fell in terror to the bottom of their cages. Nor were the inhabitants of the locality less alarmed, though accused to intimations of terrestrial instability. A resident speaks of "the people running out of bed—flying in Comrie to the meeting house, though at midnight, and remaining there for two hours engaged in devotion—abandoning all work the following day—a commercial traveller, who felt one of the lesser shocks, flying the same night—a dissenting minister, who had come to officiate, refusing to remain—several women fainting, and an impression of horror seizing upon the minds of men of the boldest youth and strongest nerve, which completely unmanned them. On the night of the great earthquake, not an eye, I believe, was closed, within this whole valley. The most careless, who were curious to feel an earthquake, never speak of them now but with terror." Many persons felt as if under the influence of electricity ; the nervous system was disagreeably affected ; and pains in the limbs, with sensations akin to sea sickness, were experienced.

Fractures and subsidences of the surface, among the ordinary effects of earthquakes, often remarkable in foreign lands, have only been exhibited on a very small scale in our country. A few examples may be cited.

The Lisbon earthquake agitated Loch Ness, and a large stone, which was lying in shallow water, was forced ashore; the rocks in the Derbyshire lead mines were heard to grind on one another, and a long narrow rent was formed in one of them; the hot springs at Bristol were coloured red, and rendered for some months unfit for use; but no material derangement of the earth's crust in Great Britain was produced by the great foreign catastrophe. On the morning of July the 15th, 1757, when shocks attended with great noise affected Cornwall, and were strongly felt in the mines, several small risings as big as molehills were observed on the sandy beach near Falmouth, having a black speck in the middle of the top, as if something gaseous or fluid had issued from it. The record is curious, as similar appearances have frequently been noticed in connexion with the great Chilian and Calabrian earthquakes. In the parish of Buildway, in Shropshire, May the 27th, 1773, several very long and deep chasms, from ten to thirty yards wide, with many minor cracks, were opened in the ground, which was in other respects thrown into a confused state, hollows being raised into mounds, and mounds reduced to hollows. A cavity from sixty to seventy yards in diameter was formed near Whitehaven during the earthquake of February, 1792. At Ripon, in 1827, there was a fissure opened nearly twenty yards wide; and another at Tynehead, in 1838, which was nearly half a mile long.

Upon reference to the dates of shocks, it appears, that they are more numerous and also more severe in certain months of the year than in others. Thus the 116 English, and the 139 Scotch earthquakes before referred to, occurred as follows:—

	England.	Scotland.	Total.
January....	11	14	74 in three Winter months.
February ..	13	14	
March	10	12	
April	10	9	44 in three Spring months.
May	4	8	
June	9	4	
July	5	5	58 in three Summer months.
August	9	12	
September..	15	12	
October	11	14	79 in three Autumn months.
November..	12	20	
December ..	7	15	
	<hr/> 116	<hr/> 139	

The table shows, that out of a total number of 255 shocks, there occurred in the winter half-year, from October to March inclusive, 153; and in the summer half-year, from April to September inclusive, 102. This numerical preponderance of British earthquakes during the winter months, is in harmony with the returns made by continental writers, Von Hoff, Merian, and Perrey, respecting those of foreign countries.

It is also a well-established result of home and foreign observation, that earthquake shocks, at all times, are preceded or accompanied by barometrical depression, indicating the diminished pressure of the atmosphere. Hence the occurrence of the greater number in the winter months, for it is well known, that the average height of the barometer is always lowest during that part of the year, and is also subject to greater vacillation than at any other season. It may therefore be considered as certain, that while the causes of earthquakes are shrouded in mystery, they are essentially connected in their occurrence with atmospheric vicissitudes. When the barometer is at 31 inches, the atmosphere presses on the surface of Great Britain with a weight equal to 291,793,239,406 tons. When it sinks to 27 inches there is a diminution of weight on the same area, equal

to 37,648,938,386 tons, being about 427,231 tons on each square mile. It is very obvious, that when the elastic forces, which are supposed to exist beneath the solid crust of the earth, have acquired such strength as to be nearly able to produce a disruption of the confining strata, any considerable decrease in the pressure of the atmosphere may bring on the crisis of actual disengagement.

Happily, our Island-Home may be styled "a quiet habitation," in relation to subterranean eruptive forces. While large tracts of the globe, both in ancient and modern times, have been ravaged by their outbreak, causing "distress of nations and perplexity, men's hearts failing them for fear," we know little by experience of such agents of disturbance beyond the fact of their existence, and feeble exhibitions of their energy. It becomes us therefore devoutly to recognise the sentiment, as a nation and as individuals, "Thou, Lord, only makest me dwell in safety;" to see His directing or controlling hand in the whole range of natural phenomena; and to praise him for the good of the land we inherit, encompassed by

"The seas,

Which God hath given for a fence impregnable."

Yet in every portion of our country, through all its geological formations, the memorials of great revolutions are before us, apparently occasioned by the violent action of internal agencies; and these monuments of change, in connexion with contemporaneous indications that their causes are still in being, admonish us that no promise of permanence or stability belongs to the present condition of things. But if natural philosophy thus intimates the end which the predictions of the inspired volume authoritatively proclaim, it hails also the

declaration of the sacred record, legibly impressed upon the face of the erupted and dislocated rocks around us, "In His hand are the deep places of the earth," who "openeth and no man shutteth, and shutteth and no man openeth." Past revolutions have transpired under the superintendence of Infinite power, wisdom, and beneficence. They have not therefore resulted in confusion, but in those orderly arrangements which are conducive to the true welfare of man, and of the whole animated creation; and which are apparent in the mountains and plains, the hills and valleys, that now adorn our land—the springs, rivers, and lakes, that fertilize its surface—the mineral wealth that is stored in its depths. So, whatever future physical changes may occur, involving the termination of the present terrestrial constitution, they will be directed by the same Divine hand; be illustrative of the same intelligence and benignity; and call forth the testimony from all holy beings, "Great and marvellous are thy works, Lord God Almighty; just and true are thy ways, thou King of saints." The personal interests of the reader will be safe, and the future of his existence be ineffably felicitous, if in the scene of his present pilgrimage he lives by the faith of the Son of God, who loved us, and gave himself for us.

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